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Proceedings of Conference on Public Policy Issues in Nuclear Waste Management

October 27-29
Chicago

Conf-761075--

PROCEEDINGS

CONFERENCE ON PUBLIC POLICY ISSUES IN NUCLEAR WASTE MANAGEMENT

Sponsored by

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

NUCLEAR REGULATORY COMMISSION

NATIONAL SCIENCE FOUNDATION

COUNCIL ON ENVIRONMENTAL QUALITY

ENVIRONMENTAL PROTECTION AGENCY

Held at

Ramada/The O'Hare Inn, Des Plaines, Illinois

October 27-29, 1976

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FOREWORD

The Conference on Public Policy Issues in Nuclear Waste Management was held at the Ramada/The O'Hare Inn in Des Plaines, Illinois (near Chicago), October 27-29, 1976, under the sponsorship of the Energy Research and Development Administration, the Nuclear Regulatory Commission, the National Science Foundation, the Council on Environmental Quality, and the Environmental Protection Agency.

In the printed program, the following PURPOSE appeared:

> THE CONFERENCE ON PUBLIC POLICY ISSUES IN NUCLEAR WASTE MANAGEMENT is designed to provide a public forum in which to identify and to discuss the legal, institutional, social, environmental, and other public policy issues relating to nuclear waste management.
>
> It is not a purpose of this Conference to debate the acceptability of nuclear energy. It is intended to encourage public input in establishing a national nuclear waste management program and to improve public understanding of the implications of technical alternatives. An exchange of viewpoints, strongly focused on issues which should be considered in Environmental Impact Statements prepared pursuant to the National Environmental Policy Act (NEPA), will be solicited to assist Federal decision making in nuclear waste management.

This statement of purpose reflects the beginning of an iterative process between the Federal government and the public. As exemplified by the meeting which is recorded in this document, the Federal sponsors have begun to reflect upon their decision making processes and the changes needed to include and encourage public participation in their energy decisions. Although each agency is likely to proceed differently, all are unanimous in their affirmation of the need to insure the acceptance of a full range of inputs into the development of a national energy policy.

This volume is a comprehensive synthesis of the speeches, papers, and discussions as they occurred during the plenary and luncheon sessions. The oral presentations--which were recorded during the Conference--have been condensed and edited for reading clarity. In some cases, where the nature of the recording required, participants were asked to edit portions of the transcript for readability.

In addition to the plenary sessions held during the day, several informal workshops were held during the evenings to provide an opportunity for direct dialogue between speakers, panelists and attendees. Although some workshops were planned prior to the Conference, others were the result of a desire to elaborate upon issues raised during the plenary sessions. Topics and their moderators included the following:

"Estimating the Sources of Social Change: The Impact of Nuclear Waste Management Options" Todd LaPorte, University of California, Berkeley.

"Risk Assessment and Nuclear Waste Management" David Smith, Environmental Protection Agency.

"International Policy Issues in Nuclear Waste Management" David Deese, Woods Hole Oceanographic Institution.

"NRC's Task Force on Goals" William Bishop, Nuclear Regulatory Commission.

"States Role in Siting Selection Criteria" Edmond Rovner, National Governors' Conference.

An Interagency Steering Committee with representatives of the sponsoring agencies initially established the Conference objectives and provided support and guidance to the session chairmen who structured the individual sessions. Members included Sandra Fucigna, NSF; Joel Stronberg, ERDA; Don Frazier, NRC; Gerald Brubaker, CEQ; and David Smith, EPA. This Committee wishes to extend its thanks to all the chairmen, speakers, panelists and workshop moderators who, under tight deadlines, assumed the responsibility for and provided significant input to this initial attempt to promote public discussion of the difficult policy issues associated with nuclear waste management.

The enthusiasm and interest of the Conference Chairman, Dean Alan K. Campbell, was especially appreciated.

OPENING REMARKS

GLEN A. GRAVES, Group Leader, Working Group on Energy, Resources, and Environment, Policy Research and Analysis Division, National Science Foundation

JOHN BUSTERUD, Acting Chairman, Council on Environmental Quality

Dr. GRAVES: Good morning. I am pleased to see that so many of you have already found the Convention Hall through our somewhat labyrinthine arrangements here. I am sure others not quite so lucky will continue to join us for someti . Hotel maps are available, if needed, at the registration desk.

I am Glen Graves, of the Policy Research and Analysis Division of the National Science Foundation, one of the five Federal government agencies sponsoring this meeting. The others are the Energy Research and Development Administration (ERDA), the Nuclear Regulatory Commission (NRC), the Environmental Protection Agency (EPA), and the Council on Environmental Quality (CEQ). On behalf of all of them I would like to welcome you, and express the hope that we will have a productive and constructive meeting, valuable to the agencies and to you as individual participants.

Before any large meeting can start, announcements and reminders are usually given. For us, those are as follows:

1) All morning sessions will begin promptly in this room (Convention Hall) at 9:00 AM and the afternoon sessions will begin here promptly at 1:45 PM, except for Friday's, which is to begin at 1:30 PM. Prompt commencement is important so we can allow maximum opportunity for questions and answers and panel discussions following presentation of papers.

2) Coffee is available outside the hall, but for the same reasons the meeting will not stop to partake of it.

3) Admissions to luncheons is by ticket only. These are available from the registration desk. The Wednesday luncheon is at 12:00 noon in the Penthouse Ballroom in the Tower, the Thursday luncheon at 12:00 noon will be in the West B&C Ballroom.

4) Some workshops have already been scheduled for Wednesday and Thursday evenings. These relate to the following topics: International Aspects of Rad-Waste Management, Public Policy Issues and Risk Assessment, and Implications of Social Change on Policy Design. Descriptions of these workshops are posted at the registration desk and outlines of topics and names of some participants will be available outside the Convention Hall later this morning. We encourage conferees to sign up for workshops of interest to them.

5) Copies of Conference Proceedings will be mailed to all those who have registered at the Conference and paid for Proceedings. These Proceedings will include transcribed copies of all papers, panel discussions, and question and answer sessions.

6) ERDA would like to bring to your attention a "resource center" located in rooms 4212 and 4213 of E-wing. This center will provide Conference attendees with a wide range of documentation relating to our subject matter, including various publications and reference materials and even a computer terminal. The center will be staffed by professionals from the Oak Ridge National Laboratory able to respond to a wide range of questions or inquiries on nuclear waste management.

Some curiosity has been expressed about the procedures used in organizing this Conference. This process involved three entities: 1) a government interagency steering committee, 2) the MITRE Corporation as a conference administrator and arranger, and 3) an external planning and advisory group from which input was solicited by MITRE at the interagency steering committee's suggestion, with representation from environmentalists, special interest groups, Congressional staff, state government, industry, media and others.

This external planning and advisory group of approximately a dozen people was chaired by Larry Moss, here today. It reviewed the early meeting proposals and made many suggestions which were responded to positively, both in the selection of agenda topics and in the meeting's organization and approach. For example, procedures were recommended and adopted to assure that the individual session chairmen had freedom in deciding how to address the broad topics under their concern, and to assure the authors' freedom of expression. No consensus of viewpoint was demanded.

The only conditions were that audience participation be part of the program and that the presentations be germane to the meeting's topic of public policy issues in nuclear waste management, as announced in advance and as mentioned in the "Purpose" preamble to the printed program.

Some have worried that the views presented by some persons under this freedom may neither represent the conventional view within the sector with which they are nominally associated, nor reflect government views, nor reflect what might be the mainstream attitudes and belief of the general public, if those were found and made known. These possibilities should be recognized and especially kept in mind by those covering and interpreting this meeting to others, but they need not much concern us here.

Today, it is the whole range of thought and view, and not just the mean, which is important and of possible interest to nuclear waste management policy formulation. The procedures employed in planning this meeting were designed to clearly develop ideas and explore their implications over much of that whole range of thought. We hope they will prove to have been effective.

With these formalities dispensed with, before I too get out of your way so you can turn to the people and topics which really interest you here, I have one last pleasant duty.

It is to introduce to you Mr. John Busterud, acting chairman of the Council on Environmental Quality and director of the Office of Environmental Quality within the Executive Office of the President. John is a member of Phi Beta Kappa, an attorney who trained at Yale, following a BS cum laude in economics from the University of Oregon. He was admitted to practice law in California in 1950 and has also been admitted to the U.S. Supreme Court and all Federal courts.

He has a distinguished history of professional and community involvement in California, including public office, with six years service as a member of the California Legislative State Assembly. He served as special counsel, equivalent to an executive director, on the successful California Constitutional Review Commission and continued on a broad-gauge legal practice before coming to Washington in October 1971 as Deputy Assistant Secretary of Defense for Environmental Quality.

He was appointed a member of the Council on Environmental Quality a year later. He has played a key role in helping shape U.S. and international policy at the Stockholm Conference on the Human Environment, the Law of the Sea Conference, the United Nations Environmental Program (UNEP), the International Conference on Ocean Dumping, and the Joint Commission of the U.S.-U.S.S.R. Environmental Agreement. He has also worked with the Economic Commission for Europe and on special reviews and tasks within CEQ.

John will now tell us more about the considerations within government driving for this meeting, about governmental responsibilities under the National Environmental Policy Act and, in his turn, present our meeting's general chairman and moderator.

Remarks of

JOHN BUSTERUD, Acting Chairman, Council on Environmental Quality

Mr. BUSTERUD: My function is that of introducing your Chairman.

First, I would like to set the stage for that introduction. Considering the thousands of meetings held in the United States every day, it may seem fatuous to describe any one of them as unique. Yet, for reasons that I will explain later, this meeting is a genuine first. Moreover, it has not only a history, but we hope an important future.

Let me begin, however, with the history. Back in September of 1974, the Atomic Energy Commission published a draft Environmental Impact Statement titled, "Management of Commercial High Level and Transuranium Contaminated Radioactive Waste." This statement spelled out AEC's plans for a national program for commercial radioactive wastes. In accordance with the usual procedure governing Environmental Impact Statements, it was circulated for review and comment by the public, and governmental agencies at every level. The review process revealed many deficiencies in the EIS itself.

Perhaps more important, however, the review evoked a great deal of concern on the part of Congress, Federal agencies and the general public about one aspect of the overall program: a proposal for the temporary storage of nuclear waste in the above-ground depositories known as "retrievable surface storage facilities," or, RSSF.

Such RSSFs do not really solve the waste storage problem; they simply give us a kind of safe deposit box in which to place nuclear wastes for awhile, so that we can pull them out later when we have figured out a permanent solution. And though the proposed RSSFs were attractive from a purely technical standpoint, public reaction to the Impact Statement showed that nontechnicians were very reluctant to accept them.

What this boils down to, I guess, is public skepticism about the assurances of engineers and scientists in the face of such long-term risks as those inherent in nuclear waste management.

At any rate, the proposed program was not met with great enthusiasm, to use a euphemism. Somewhat later, the AEC was split into two new agencies, the Nuclear Regulatory Commission, and the Energy Research and Development Administration. Much of this, by the way, is primer stuff to those of you here, but I want to review it for

those of you who may not be that familiar with the organizational structure.

In April 1975, ERDA, which had inherited the AEC's responsibility for management of nuclear waste, withdrew the draft impact statement and its budget request for RSSFs. In a letter to the Joint Committee on Atomic Energy, Dr. Robert Seamans stated that after taking a fresh look at the criticisms of the proposed waste program, ERDA had decided a new and expanded environmental review was in order. To assist in that review, ERDA sponsored an international symposium on waste management, last July in Denver, Colorado. That meeting focused on technical solutions to the problem.

Reflecting the government's experience with the earlier proposal, however, a number of people concerned about this problem, believed that another type of conference might be useful. One that would focus on the institutional issues of the various technical alternatives proposed. This Conference is the result.

Few issues today hold broader societal implications than those concerning nuclear energy. We live with the constant possibility of another oil boycott, which would cut off most of our oil imports. We are one of the world's most fortunate nations with respect to our supply of coal, but coal also presents formidable environmental problems. Not only in its mining, but in its transportation and conversion.

Such technologies as synthetic fuels and coal gasification require formidable amounts of capital...amounts which industry hesitates to risk, and which government is reluctant to furnish or guarantee. We hope for the rapid development of such safe and infinitely renewable energy technologies as solar. But even though a remarkable amount of progress has been made in that area, since we started to get serious about it, we cannot prudently rest our needs for energy on breakthroughs that may or may not materialize when we need them.

And despite the obvious economic as well as environmental benefits of energy conservation, we have yet to put together an effective, comprehensive program aimed at such thrift. At present, nuclear energy supplies only about 9 per cent of our electricity generating capacity. And despite what appears to be growing public skepticism about nuclear energy, as witness the citizens' initiative on the ballots of six states next Tuesday, many people, including some environmentalists, believe that the light water reactor will have to play a major part in meeting our energy needs until new technologies begin making a substantial energy contribution.

In my view, a key issue affecting the future of the light water reactor is the need to develop a satisfactory nuclear waste management program. No other problem transcends this one; as a test of

strength for our public decision-making processes, for our political and social institutions, and indeed, as a test of our intellectual capacity.

Many of the issues confronting us in this Conference stem from two unique characteristics of nuclear waste. First, they are radioactive, and thus, potentially damaging to man and the biosphere. Second, this radioactivity will persist for time spans that utterly exceed the period for which we are accustomed to making decisions.

The best known example, of course, is plutonium, with a half life of over 24,000 years. With the single exception of the family, no human institution, no code of laws, no set of religious or ethical beliefs, and certainly, no government has lasted that long. From these distinctive properties of nuclear waste, flow the implications and issues for this Conference.

Some of the issues are philosophical. For example, our obligations to future generations, and their right to an environment whose waters and soils do not conceal a multiplicity of forgotten nuclear booby-traps.

Other questions are more mundane and immediate. The humble fact is that we not only have nuclear waste, but we are generating more every day. Whatever long-term solutions we may find, we know that we have to put those wastes somewhere. And everywhere in the world there are people. People whose concerns must be addressed.

There are issues of equity involved here. Some locations and nations are obviously better suited for the long-term storage of nuclear wastes than others. How do we respond to the concerns raised by the people who must live near the sites chosen? These are some of the issues we must probe and understand before we can satisfy the public's demand for an acceptable method of disposing of nuclear wastes.

The major purpose of this Conference is to confront this justifiable public concern over the details of any proposed national radioactive waste program. Coupled with the information from the technical symposium held in Denver, the deliberations from this Conference will lead to a Generic Environmental Impact Statement, to be completed and published by ERDA in 1977.

As many of you know, such statements are required from any Federal agency contemplating a program that will affect the environment, under the provisions of the National Environmental Policy Act. It is CEQ's job to coordinate this process among Federal agencies.

It may also help you to understand the responsibilities of the other Federal agencies most involved in nuclear waste management.

ERDA is responsible for choosing waste disposal sites, as well as for developing and demonstrating safe technology. That agency must, in addition, evaluate the effectiveness and environmental impacts of alternative storage methods.

The Nuclear Regulatory Commission, charged with ensuring public health and safety, must regulate the storage program through a licensing process. Thus, ERDA must obtain a license from NRC for its waste facilities, including geologic repositories.

Finally, the Environmental Protection Agency will provide general environmental guidance. At present, EPA is engaged in setting ambient radiation standards within which the programs must operate. In addition, EPA is charged with monitoring environmental radiation beyond the boundaries of the individual waste management facilities.

I mentioned at the outset that this Conference is a first of its kind. To our knowledge, no Federal agency has previously sponsored a national meeting to solicit information that will be used in preparing an Environmental Impact Statement. Hence, we at CEQ look with great interest on the outcome of this Conference, not only for its potential value in improving the quality of EIS's, but also, as a possible instrument for guiding Federal decision making in other national programs of great significance.

I want to commend the officials of ERDA, NRC and EPA for their willingness to participate in this novel approach, and to thank the National Science Foundation for helping to sponsor it. I would be remiss, too, if I didn't thank the many participants in this Conference from the public sector for being here.

But I want to emphasize that the ultimate success or failure of this Conference rests primarily on the quality of thought communicated here. Your ideas, objections and suggestions will be carefully considered in the preparation of the Generic Environmental Impact Statement. That document, in turn, will be circulated in draft form as a vehicle for obtaining an even wider range of views through the review and comment process.

I believe that we've planned a program here that will help identify the key issues in nuclear waste management decisions. But any program, no matter how well planned, can go astray without an experienced and perceptive moderator to guide it. In that respect, I think we are extremely fortunate today to have with us Alan K. Campbell, Dean of the Maxwell School of Citizenship and Public Affairs, at Syracuse University.

Dr. Campbell holds undergraduate and advance degrees from Whitman College, Wayne State University and Harvard, where he took his Master's

Degree in Public Administration and his doctorate in political economics and government. In addition to an astonishing production of articles, monographs and books on public finance and administration, he has held a variety of posts and consultancies with New York State and with the Federal government. He was, for example, an elected delegate to the New York State Constitutional Convention.

If it is true that great minds run in similar channels, I am happy to point out that I helped to organize the Constitutional Revision Effort in California and drew very heavily on New York's prior experience in that area.

Dr. Campbell has also served as Deputy Controller for Administration and Research in New York State. And was a member of the State Council of Economic Advisors. On the Federal side, he has been an advisor to the Departments of Health, Education and Welfare; and Housing and Urban Development; to the National Science Foundation; and to the National Institute of Education. At present, he is a consultant to the Advisory Commission on Intergovernmental Relations. I take a great deal of pleasure now in turning this Conference over to its distinguished moderator, Dr. Campbell.

SESSION I: STATUS AND KEY ISSUES IN CURRENT WASTE MANAGEMENT PROGRAM

MODERATOR: ALAN K. CAMPBELL, DEAN, MAXWELL SCHOOL OF CITIZENSHIP AND PUBLIC AFFAIRS, SYRACUSE UNIVERSITY

Presentation of papers by:

CARL W. KUHLMAN, Assistant Director for Waste Management, Division of Nuclear Fuel Cycles and Production, Energy Research and Development Administration

JOHN W. BARTLETT, Nuclear Waste Technology Program Office, Battelle-Northwest Laboratories

Overview statements by:

LAURENCE I. MOSS, Energy/Environment Consultant

EDMOND ROVNER, Legislative Director, The National Governors' Conference

HAROLD P. GREEN, Professor of Law, National Law Center, George Washington University

Dr. CAMPBELL: I think I probably have a kind of unique situation at this Conference, since as was clear from the vita items mentioned by Mr. Busterud, I claim no expertise in the field of nuclear energy or nuclear waste management. To the extent that I do have any expertise, it relates to efforts to understand the policy-making process and the resource allocation system which we use in the public sector of American society, primarily.

I have done a lot of reading over the last several weeks in an effort to at least get some understanding of the nature of the issues in this field. One of the nice things about that in starting in a new area is the learning curve is very steep in the beginning, and I think I've about reached the plateau point in that learning curve now.

In that reading, however, I have been impressed by the amount of

debate, disagreement and argument which exists in the field; a difference not only between social scientists on one hand and natural life scientists on the other hand, but even within those groups themselves.

I was reminded, while going through this process, of an early experience I had as a teaching assistant at Harvard University in the Elementary Government Course, which was a theory course and the main lectures were given by the eagles in the department, and the assistants handled sections. One of the eagles involved was Professor Carl Frederick, whom some of you, I'm sure, know; and in the treatment of Hobbes in that course, he treated Hobbes as a totalitarian. In sections, I argued that that was incorrect; that he was in fact an absolutist, a difference at that time I thought quite significant.

There was a question on the exam about Hobbes and one of the students responded, "It is indeed difficult to choose betwen the two brilliant interpretations of Hobbes given by Professors Frederick and Campbell, but of one thing we can be sure, Hobbes was wrong."

I'm not sure who, in the nuclear scenario plays the Hobbes role, but be that as it may, it is obviously a field, as we all know who read the daily newspapers, dominated by a great deal of discussion and debate and I think in that sense this Conference takes on great importance. And I am pleased and proud to be associated with it.

The purpose of the Conference, as those of you who read your program know, and in the words of its sponsors, is to articulate and address the public policy issues associated with nuclear waste management. Underlying the Conference is the belief that the social, political, institutional and economic issues require an effort comparable to--if not greater than--that currently devoted to the resolution of the technical problems.

This Conference's purpose, it seems to me, highlights the growing complexity of public decision making in our society. That complexity manifests itself in at least two ways: one is the difficulty increasingly recognized of determining the underlying causation of behavior which society would like to change or control. One needs only to mention crime and the recent performance of the economy to demonstrate the difficulty in developing and applying policy which will accomplish desired results.

There is, in the first place, no agreement, even among so-called experts of causation, and even if there were, there is no certainty that the economic means of the political will, or the institutional capability exists to adopt and implement the necessary policies which would emerge from an appropriate causation analysis.

Another chief contributor and one of importance to us in the complexity of the decision-making process is the increasing scientific and technical content of many policy areas.

The public may believe that they understand the debates about crime, the economy, and similar issues. Although, even in those areas, the concept and language used are becoming increasingly specialized. But issues related to the natural and life sciences are shrouded in the mysterious language and the strange folkways of the scientific community. Pronouncements and recommendations from that community were, perhaps, in the past, accepted on faith.

I think we now are all aware that that is no longer the case. And it is not the case for several reasons. Disagreement among scientists themselves in areas in which they claim and are believed to be experts about both technical and policy issues have puzzled and disturbed the public.

More important, however, than this uncertainty about scientific or technical feasibility or advisability of specific policies created by disagreement among experts, is the growing recognition that all public decisions, whatever the extent of their reliance on scientific and technical knowledge, possess social, political, economic and institutional consequences. Such decisions, therefore, however soundly based on appropriate technical or scientific knowledge, are in no way neutral in terms of their impact on society.

This Conference is recognition, it seems to me, of that fact. It recognizes that the technological processes have a life and a logic of their own, just as do economic, social and political processes. They exist side by side in uneasy coalition and often in conflict in every society.

The outcome of any one of those processes is in no sense superior to that of any of the other. We are all aware of the frequent claims that such and such a good thing could be accomplished were it not for political obstacles in the way of its accomplishment. Or that this useful social goal could be obtained were it not for the hindrance of the economic system.

When one of the processes is not allowed to work itself out, because of resistance from others of the processes, frustrations result and those frustrations work themselves out in bitter debates and in recent years, as we have seen, in confrontation politics. And it seems to me that that is an inevitable result of the fact of the internal logic of each of the processes.

Underlying, of course, these conflicts among the processes are values and beliefs. They cannot be escaped, for in the end, even if

all objective facts are understood and agreed upon--seldom the case, but even when that is the case--the consensus about what they imply for public policy will not automatically emerge.

If different values are applied to agreed facts, different policy recommendations will result. And certainly, this is the case in the nuclear energy field, where not only do we have the difference of results coming from the application of different values, we still have disagreement even about the underlying scientific facts.

Despite this inevitable, and I believe, appropriate role of values, a necessary first step in intelligent decision making is to try to fully illuminate the issues by airing, not just the scientific and technical arguments and facts, but social, economic and political and institutional conditions, as well.

This Conference will, I believe, make a significant and useful contribution to that end, if we remember what I think is terribly important, which is that objective analysis must not in the process be abandoned. Do not believe that all opinions are equally valuable. There is a difference between informed and uninformed opinions.

The issue with which we will be concerned for the next three days is nuclear waste management.

As the recent report, which many of you I'm sure have seen, of the British Royal Commission on Environmental Pollution says, "There are few subjects in the field of environmental pollution to which people react so emotionally as they do to radioactivity. One reason for this is certainly the association with the destructive uses of nuclear energy."

I would add to that statement by that Royal Commission that the complexity of the processes related to the production and use of nuclear energy also increases the uncertainty on the part of the public about appropriate attitudes to adopt in relation to this technological issue. The argument among experts adds to that public uncertainty.

The sensitivity of the issue, however, is not justification, as our attendance here demonstrates, for its avoidance. But rather, it is an added justification for its exploration. Until such exploration is undertaken, the field will continue to be a matter of mystery and the cause of great fear.

Again, as the Royal Commission said, "We have noted that the debate is not always well informed, that sometimes relatively minor matters receive attention to the exclusion of others potentially more important and that the context is often poorly defined." It is hoped this Conference will help to overcome these attributes of the

debate which are, I believe, as prevalent in this country as they are in the United Kingdom.

It is important that all of us understand the subject matter of the Conference is nuclear waste management. We're not here to discuss nuclear power in all of its ramifications. We are here to discuss as the Conference planners made clear in the title of the Conference, the management of nuclear waste. The problem of such management will continue to exist, even if there were declared today a moratorium on the construction of any more nuclear power plants.

Again, the Royal Commission says it well when it points out, "These wastes already exist in substantial quantities, and a safe method for their long-term disposal is in any case required, whatever is decided about nuclear development in the future."

Some may argue that this restriction to only one aspect of the nuclear field is unfortunate, and perhaps even impossible. I think, however, that the planners of the Conference were right in attempting to divide the subject in a way which can focus our discussion.

I think that we would all agree that advancement of knowledge and understanding in any field is only possible when that subject is divided in a way which permits the focusing of attention on specific parts of it. To lose that focus reduces the value of our deliberations.

There are other issues related to nuclear energy as we are all too well aware. And, one hopes, there will be other places and other times when those too can be discussed in a forum of this kind.

I'd like to comment on this forum and what stands behind it in terms of attitudes on the part of the government. I speak only for myself and not for the organizers of the Conference, but I believe it important and significant that a group of government agencies decided to hold under their sponsorship a public conference about a topic as controversial as this one.

We're all aware that during this particular moment in the life of America there is a substantial public distrust of government. I believe the willingness of responsible government agencies and departments to sponsor and organize a public forum providing an opportunity for a discussion of the kinds that will occur here is useful and, hopefully, only one of the many steps of this kind which will be taken in an effort to restore some trust in our governing institution.

The willingness of government to operate openly, to not only receive, but to invite criticism, is the only acceptable route, I believe, to the restoration of that confidence. Further, it is essential that once organized, efforts of these kinds are carefully

listened to by those who have in fact the policy-making power in their hands.

It seems to me that we should be reassured by the assurances we have from the various responsible agencies that they will indeed be listening; and, we have a specific way to determine the extent of that listening, because the preparation of the Environmental Impact Statement on commercial waste management to be issued in the Spring of 1977 offers a unique opportunity to consider and implement the views of the technical and social experts which we hope will emerge from this Conference.

It seems to me, too, that this fact makes particularly significant the last session in this Conference, for it will be the focal point for bringing together what in fact has taken place in the sessions which occurred before it. The presentations by the session chairmen will be theirs as individuals but will be drafted on the basis of extensive discussion with speakers and panel participants, and will use all the information possible developed at the Conference. It is these presentations which I think will help to tell us whether we have in fact made progress in illuminating the issues, as is the purpose of the Conference.

For this kind of debate and discussion, and in view of the number of participants here, it will be necessary to follow somewhat orderly and understood procedures. The pattern of each session will be for papers to be presented by people invited for that purpose; for comments to be made by panelists on those papers; and, then for questions from the audience.

We will make every effort to provide time for questioning and the session chairmen have been instructed to try and hold the formal presentations to time periods which will make possible that kind of exchange between the panelists and the speakers and those of you here to discuss these issues.

We begin the substantive work of this Conference by turning first to a description and explanation of the current situation in this field and options that may be available for other approaches. The first two speakers will address themselves to those two questions.

The first speaker is Carl W. Kuhlman--known, I know, to many of you--who is the Assistant Director for Waste Management, ERDA's Nuclear Fuel Cycle and Production Division. He's held that position since October 1975. From January 1973 to October '75, he was Director of the Division of Materials Inspection Program of the Nuclear Regulatory Commission. Before joining the Nuclear Regulatory Commission which was then the Atomic Energy Commission, he was Vice President and Assistant General Manager, Douglass United Nuclear in Richland, Washington.

His career has been in the nuclear industry since 1945, both in relation to reactors and the fuel cycle. He holds an undergraduate degree of Bachelor of Science from Harvard, and a Ph.D. from Washington University in St. Louis, in Physics and Chemistry. It's a pleasure for me to get this Conference started by introducing to you Dr. Carl Kuhlman

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"ERDA Waste Management Program"

CARL W. KUHLMAN, Assistant Director for Waste Management, Division of Nuclear Fuel Cycles and Production, Energy Research and Development Administration

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Dr. KUHLMAN: One of the very first programmatic actions of the Energy Research and Development Administration, upon its formation last year, was to review the nation's energy needs and possible solutions offered by various energy systems.

Nuclear energy, obviously, featured prominently in that study. Realization of the potential contribution of nuclear energy was bound to require solution of several problems in the commercial nuclear fuel cycle, including the very fundamental one of commercial nuclear waste management.

Therefore, a decision was made to decisively expand the attack on radioactive waste management across-the-board; both commercial waste and waste at ERDA sites. The commercial waste management program that developed from that decision is basic to this week's meeting.

This new look at the radioactive waste problems of the commercial fuel cycle began with an extensive analysis of the state of waste management technology, which has been documented in the five-volume Technical Alternatives Document. This Technical Alternatives Document, "TAD" as it is commonly called, was issued in May of this year, and in July, a related public meeting was held in Denver.

Although the July meeting included review of waste management policy by leaders of foreign countries and of various Federal agencies, considerable emphasis was given to the review of the contents of the TAD and direct discussions between interested members of the public and the technical experts who had been responsible for the various sections of TAD.

In addition to serving as the foundation for the expanded ERDA program, the Technical Alternatives Document was also intended to provide a technical basis for the preparation of a comprehensive Generic Environmental Impact Statement, covering waste management options of the post-reactor fuel cycle. This Environmental Impact Statement is now being prepared by a large number of people throughout the country under the general coordination of Carl Unruh of the Battelle Northwest Laboratories. It will be published in draft form in the Spring of next year, at which time comments will be requested in accordance with the usual NEPA procedures.

Now, while preparing for the Denver symposium, suggestions were received from a variety of sources, that there were a number of social and economic phases of radioactive waste management which might not fit into a basically technical symposium; but which would merit exploration and a public meeting. The positive reaction of ERDA and other agencies to this idea has resulted in the presently jointly-sponsored meeting.

The TAD document and the Denver meeting hopefully provide a technical background so that the discussions in the next three days can take place with a common understanding of the options provided by technology, and the limitations imposed by nature.

Many of the subjects to be discussed here will impact on the preparation of the Generic Environmental Impact Statement, and as a result the team working on that statement is well represented in this audience as very interested listeners. While the technological considerations must define the basic options available, it is equally true that particularly in the case of a subject like radioactive waste management, social, economic and environmental, and other public policy issues are of cardinal importance.

As an introduction to the discussions of the next three days, I would like to summarize the ERDA commercial waste program. I will treat the subject in rather general terms, since the next speaker, John Bartlett, is going to deal in more detail with the technology of waste management.

The ERDA decision to propose a major revision in the waste management program was approved by the Administration and made public in the President's budget proposal to Congress for Fiscal Year 1977. Lights, please.

(See Figure 1.)

The first slide shows in gross form the magnitude of this initiative. The 1977 proposed budget totaled $90 million for commercial and defense waste, compared to a Fiscal Year '76 level of just under $31

WASTE MANAGEMENT OPERATING BUDGET

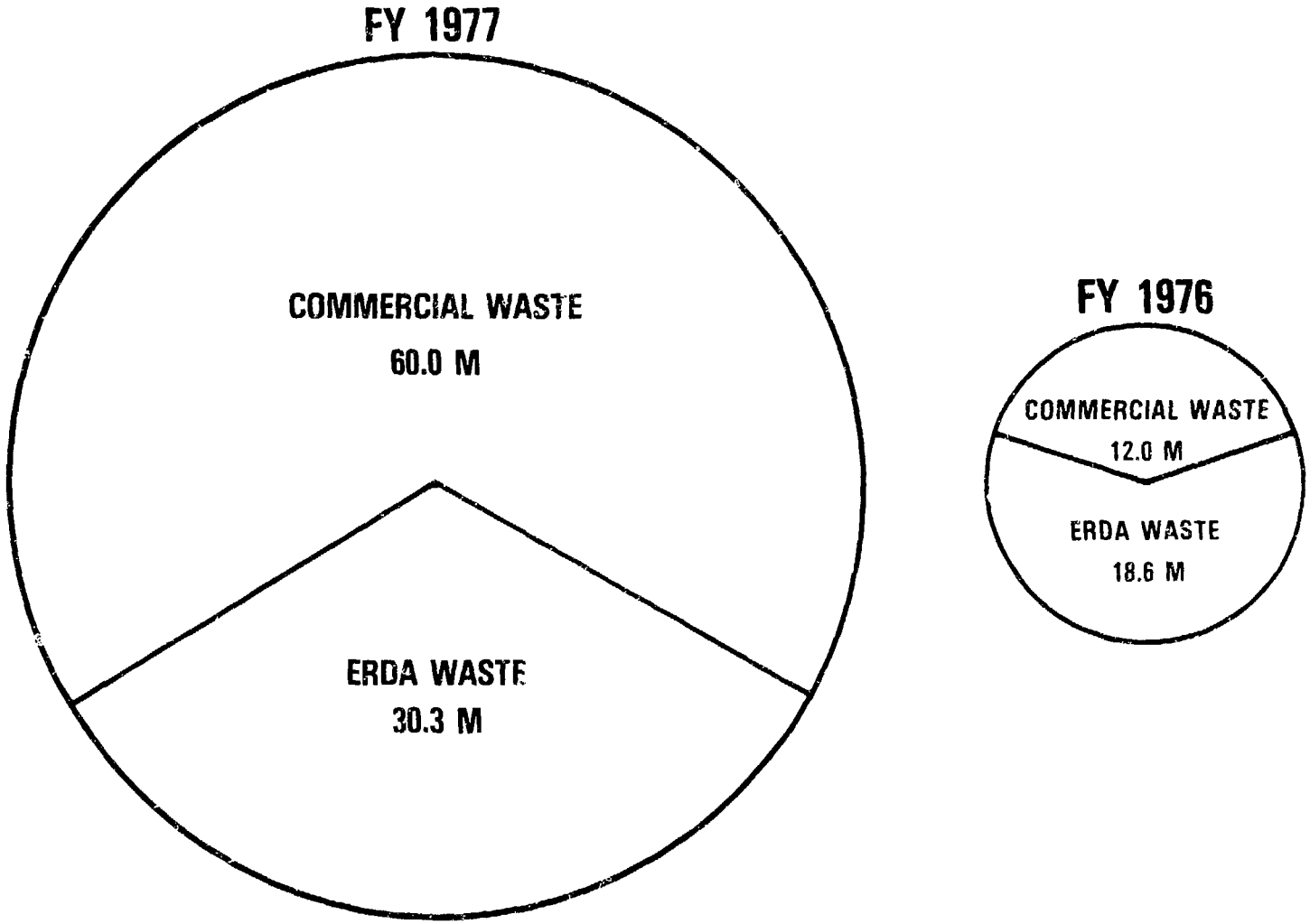

Fig. 1

million; an increase by a factor of three. The increased emphasis on commercial waste is even more dramatic, a factor of five. In the appropriations process, Congress added $5.6 million to the proposed budget, and the modified appropriations bill has been signed by the President.

It seems reasonable to infer from these budget sections that Congress shares the determination of the Administration that the waste problem be attacked decisively now. As further evidence of the Administration's interest in decisive action, a statement of the Energy Resources Council was presented to a committee of Congress last May, which contained a coordinated time-table involving six agencies of the Federal government leading to a national repository for high-level radioactive waste in 1985.

The review of the status of waste management technology documented in TAD concluded that basic technology was available for processing and disposing the waste streams from the fuel cycle. Application development was necessary, in several cases, to provide practical processes. For example, solidification of high-level waste, treatment of hulls and transuranic waste. Further, of course, a repository for high-level and transuranic waste must be constructed applying the basic available technology.

Now, the present ERDA waste management program consists of three general parts. First, terminal storage; this consists of the development and the provision of a repository for waste. Second, waste processing--the development of technology for the conversion of all forms of radioactive waste into a suitable form for packaging, transporting, and final disposition. Finally, preparation of the Generic Environmental Impact Statement, consisting of a systematic evaluation of the environmental impact of alternative methods for dealing with the various streams from the back end of the fuel cycle.

The pending GESMO decision by the Nuclear Regulatory Commission as to whether plutonium recycled will be permitted obviously influences the type of waste management technology required. If a negative GESMO decision results in a decision by industry not to reprocess spent fuel, the fuel elements themselves may become waste. The ERDA commercial waste management program provides for both options: reprocessing, or no reprocessing.

Similarly, the Generic Environmental Impact Statement treats both options.

Lights, please.

(See Figure 2.)

ERDA's basic approach to the handling and storage of radioactive wastes involves a concept of multiple barriers between man and the waste. High-level radioactive waste will be converted from a liquid into a stable solid form and sealed into a high-integrity container. In this state, the waste is in a safe form for shipping and handling and should maintain its integrity for many years.

The encapsulated waste will then be placed in a stable geologic formation--a geologic formation such as salt beds which have been in existence for hundreds of millions of years can provide the final containment of the waste and isolations from man for the approximately quarter of a million years required for decay of the waste.

(See Figure 3.)

Note that the extremely small extrapolation of the known history of the formation necessary to accommodate even the decay of plutonium is shown on the charts by the width of the lines separating the past from the future.

Incidentally, if one considers the level of hazards to mankind in the environment already present in the form of natural pitchblende deposits as acceptable, it is possible that the length of time involved may be less than 1,000 years.

Since the ERDA geologic approach to waste isolation is directed at repositories in locations free of pathways to the biosphere, no special dependence on a natural capacity of soils to retain plutonium and fission products is involved.

It is interesting to reflect that a much more dramatic waste isolation problem than presented by the fuel cycle was apparently solved by nature on its own, without any engineering assistance from man. I refer to the "Oklo Event," which occurred over 1.8 billion years ago, when a rich uranium deposits in an area that is now the Oklo Mine in the Republic of Gabon, Africa became the location of several natural nuclear reactors lasting for thousands of years.

As a result of the nuclear chain reaction, metric ton quantities of plutonium and fission products were produced. By carefully examining the regions surrounding the event, it has been found that plutonium and most of the fission products were essentially contained within the formation.

Now, of course, the data from Oklo is only valid for that particular type of geology, geochemistry and climatic conditions. But if similar events in the other formations are found, important further insight would be provided into plutonium and fission product migration through soils over geologic time periods.

BARRIERS TO THE ENVIRONMENT

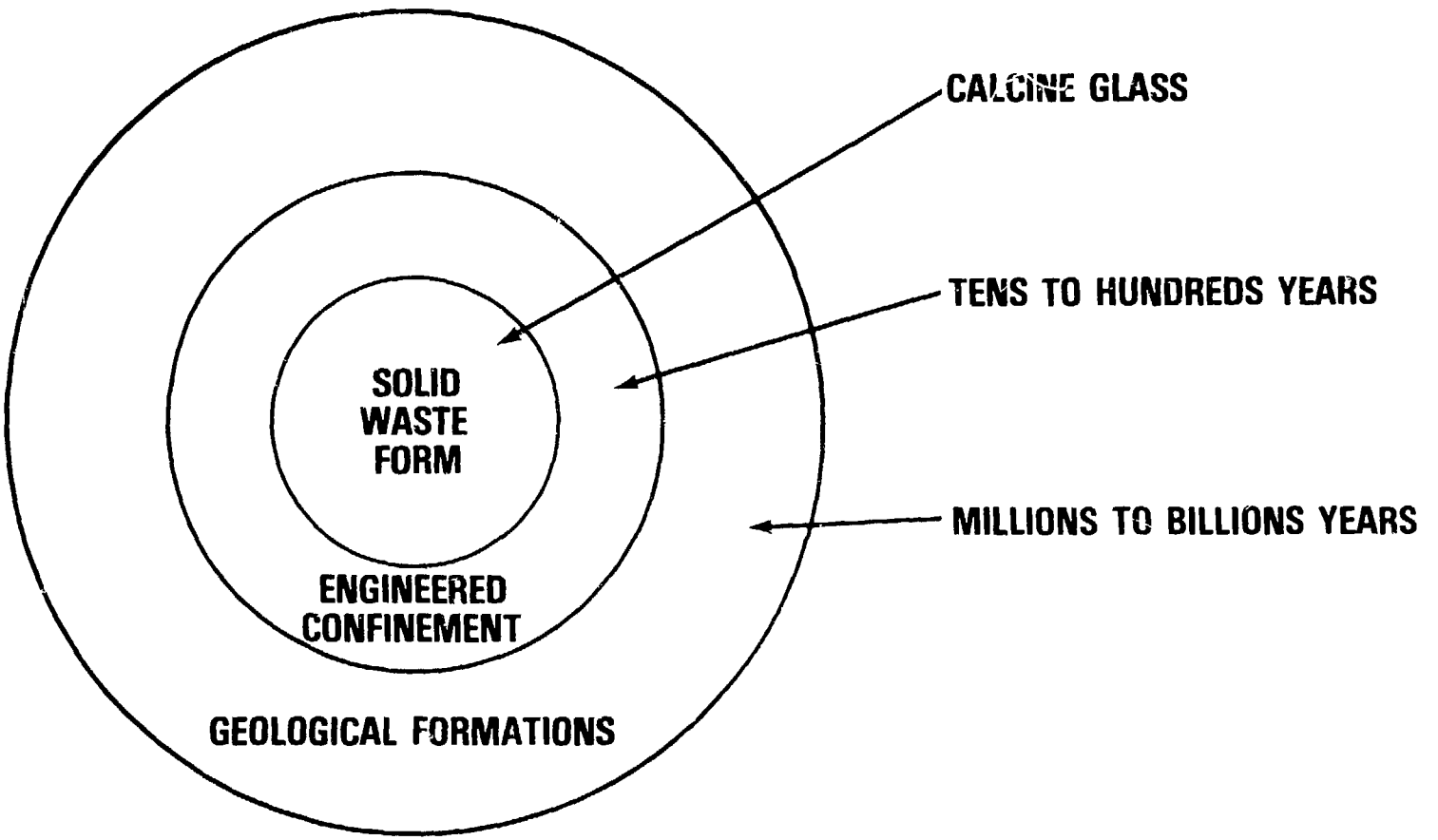

Fig. 2

TIME SCALES FOR GEOLOGIC STORAGE

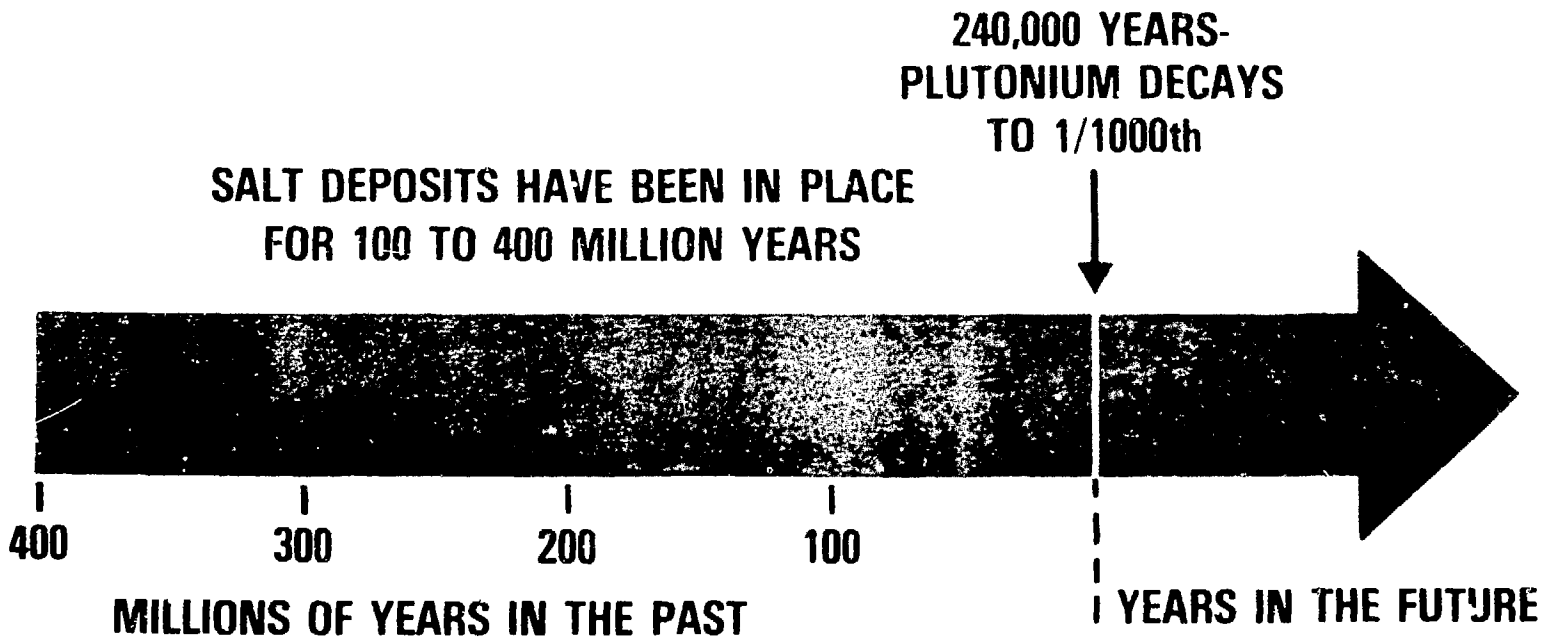

Fig. 3

I might add that the lack of migration at Oklo was consistent with predictions made from basic understandings of chemistry and migration mechanisms. This Oklo event is described in the July issue of Scientific American.

Now, emplacement in geologic formation was identified as the most practical, environmentally satisfactory disposal methods for high-level and transuranic waste after the alternatives of emplacement into the sea-bed, ice sheet disposal, and partitioning, followed by transmutation or extraterrestrial disposal were found not to offer promise for application within the next decade.

The geologic disposal option has been under study in this country with varying intensity since about 1958, and the present ERDA program is based upon that background. Furthermore, this concept has been carefully investigated by two special committees of the National Academy of Sciences and given strong support. This support was formally illustrated recently by the very strong testimony of Dr. John Frye, previous chairman of the National Academy of Science Committee on Radioactive Waste Management at the McCormick Subcommittee hearings of the Joint Committee on Atomic Energy on May 11 of this year.

Three types of geologic formations are believed to be satisfactory for a repository: salt, crystalline rock, such as granite or basalt: and the argillaceous rock, such as shale. Some 45 of the contiguous 48 states are associated with at least one of these major formations.

The ERDA terminal storage program provides for the development of sites for six repositories, with the first two repositories available for receiving waste in 1985. Because of the extensive experience with salt in the past AEC program, the first two repositories are planned for salt. The four following repositories are expected to be in both crystalline and argillaceous rock.

Suitable formations of each type are now known so that the basic thrust of the program is the location of suitable local examples of the formations free of local defects, such as appropriate depth, free of circulating water with potential for reaching the biosphere, free of major cracks, appropriate seismic prospects and a number of others.

When completed, the repository would consist of a large number of excavated rooms, located thousands of feet below the surface of the ground. On the surface would be located receiving and handling facilities for containerized solid waste or spent fuel, which would be delivered by truck or rail. The surface facilities would occupy approximately 100 acres, and would be the only visible evidence of the respository on the surface. The subsurface excavation for a full-scale facility might occupy a land area with a radius of about one mile.

Surface areas above the excavation but outside the fence around the surface facilities could be leased for general land use. Surrounding the central excavated area, would be an outer control area with a radius of about four miles, in which deep drilling would be controlled to avoid compromise of the long-term security of the repository. Land over the outer controlled area would probably not be restricted from normal usage.

These repositories, when they are initially opened, will be designed and operated in a way that permits waste to be removed as easily as it has been placed; if unexpected events should indicate the repository is unsatisfactory. I want to emphasize the respository as constructed will be expected to be a permanent disposal place for the waste and the retrievability feature is to be exercised only if the unexpected occurs.

The repositories will be subject to the licensing and other regulatory authorities of the Nuclear Regulatory Commission. Hence, we anticipate that the retrievability feature of the early phase of the repository will be one of several license conditions imposed by the Nuclear Regulatory Commission.

In addition to the independent review of each high-level waste repository which the Nuclear Regulatory Commission licensing mechanisms will provide, the ERDA program provides for close and continuing state involvement during the progress of the work. This state participation could be by one or more state agencies, or it might be through a special committee such as functioning in New Mexico in connection with the Carlsbad project.

ERDA is depending on discussions and reviews with state authorities beginning with the very early screening of possible formations and sites to assist in the design and execution of the program. We expect intense local interest in the program, and a special effort will be made to adequately inform and consult with the concerned public. In addition to a repository for waste, processes are required to convert the various waste streams from the post-reactor fuel cycle into chemical and physical forms suitable for transportation and emplacement. Unlike terminal storage, the product of this part of the ERDA program is technology for the adoption by industry at their initiative.

The 1975 ERDA review of the waste management processing technology clearly identified solidification of high-level waste streams from reprocessing plants as by far the most critically needed process development requirement. While basic technology was found satisfactory, application development was clearly necessary.

It is generally agreed that the product from a solidification process should be chemically and radiolytically stable and at least

in its packaged form should retain a monolithic characteristic on impact. The solid, in its container, clearly must last for the period of transportation and emplacement; and further, for such time as the repository is operated in a retrievable mode.

Considerable characterization of the various candidate solid forms has been done. The data obtained must now be used for formal analysis studies by both ERDA and the Nuclear Regulatory Commission. These analyses have been started and will be continued in the present program. At least preliminary regulatory guidance is expected from NRC by the end of this calendar year.

A variety of potential solidification processes are now available from former AEC work. A unit producing a borosilicate glass product from a spray calciner has been successfully operated with hot simulated commercial waste at a rate which would have been sufficient to handle the waste from the Nuclear Fuel Services reprocessing plant before it was shut down for expansion. The calciner part of this process has been operated successfully with a simulated waste stream without radioactivity at a rate 60 per cent of that required to accommodate the waste stream from the new Allied General Nuclear Services reprocessing plant at Barnwell, South Carolina. In addition to the spray calciner, a fluid bed calciner process is in a similar state of development.

While borosilicate glass is receiving early prominence in the hot pilot plant program, other waste forms will continue to be investigated. It is likely that more than one waste form may meet the eventually established criteria for terminal storage.

Examination of the technology for handling waste streams other than high-level, generally found acceptable commercial procurable hardware and processes. Two areas were identified where incentive for methods of greater efficiency was sufficiently great to receive special emphasis in the ERDA program. These are methods for reducing the volume of hulls and from the head-end step of the reprocessing plant and methods of reducing the volume of transuranic-contaminated combustible waste. The ERDA program supports work on several improved processes for each of these waste streams.

Now, obviously, if a negative decision by the Nuclear Regulatory Commission on plutonium recycle should result in a decision by industry not to reprocess fuel, the fuel elements themselves may become waste to be emplaced in a geologic depository. A technique for emplacement and retrieval of fuel elements was demonstrated in a general way, as long ago as 1960, in connection with Project Safe Vault. Compared to the solidification of liquid waste from a reprocessing plant, little more processing type R&D is required.

In addition to the research and development program for commercial radioactive waste, the '77 Presidential budget numbers indicated a large increase in the program for radioactive waste in the U.S. military program, with emphasis on the permanent disposition of the large backlog of these latter wastes. While this program, per se, is outside the scope of this meeting, we do expect that some of the developments originating in the defense waste program will be applicable to commercial waste and vice-versa. Both programs are structured to exploit this possibility.

What is the magnitude of the high-level waste problem? Most of the commercial high-level waste has yet to be generated. At this time, all of the high-level waste generated to date in the United States consists of 600,000 gallons of liquid waste, stored in modern tankage at the NFS facility outside Buffalo, New York.

Since no reprocessing plant is operating, no further high-level waste is being produced; none will be produced until either a reprocessing plant begins hot operation, or utilities declare spent fuel to be waste. A typical 1,000 Megawatt reactor will eventually be responsible at the fuel reprocessing plant for about 65 cubic feet of solidified high-level waste per year. The accumulated volume of high-level waste from power reactors through the year 2000 has been estimated as equivalent to a cube 72 feet on the side.

The expansion of nuclear power demands resolution of the waste disposal issue. The provision of a demonstrable safe and environmentally acceptable terminal disposal method in the earliest practical time period is a necessary step for securing public acceptance of nuclear power.

A national program has been conceived by the Administration and supported by Congress to decisively attack the waste management problem. The major ERDA program beginning this month comprehensively addresses all of the waste problems identified with the post-reactor part of the fuel cycle. Process capability will be developed for the use of private industry to convert each of the various waste streams into forms in which they may be safely transported and terminally stored.

A number of areas in the United States have been identified as underlain by geological formation with the properties desired for terminal repositories. The scheduled program, assuming continuation of the momentum of the 1977 budget, provides an excellent prospect at having several repositories constructed in time to receive waste when it must be shipped by commercial reprocessing facilities.

Finally, improved communications are planned with state, local and regional officials and members of the general public to maximize

the chances of this vital program being understood and accepted on both technical and nontechnical bases. ERDA is now developing methods whereby these groups can assist in a meaningful way the development of an operational plan for commercial waste management which will meet the national need.

In bringing these remarks to a conclusion, I would like to return to my earlier point, that technical issues and public policy issues are not separable. Over a period of years, the United States Congress has prefaced many statutes with legislative findings; among these many findings are that there should be full productivity and full employment; that the peaceful uses of atomic energy can and should be developed, and that the environment should be protected. The translation of these findings into practical actions obviously takes a bit of doing.

We, in ERDA, recognize that we have the technical responsibility for any radioactive waste which must go into Federal custody. However, technical responsibility does not also mean a monopoly on wisdom, especially wisdom in areas of public policy. No responsible person in ERDA believes that we can, or should, operate the commercial waste program behind closed doors.

We need and want the views and suggestions of those of you in other agencies, in environmental groups, in industry, in unions, in the academic community, and those of you that are not in any special group at all. ERDA representatives will be on hand throughout the present meeting to listen carefully to these discussions.

I would like to close by suggesting as a thought for the remainder of the meeting, that it is going to take careful, responsible thinking, communicated in a careful responsible manner, with strong emphasis on positive solutions on the part of all of us if our national energy goals are to be met.

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Dr. CAMPBELL: Thank you very much, Carl. Continuing with the background information which we believe will be useful in the discussions which follow, I would like next to introduce John Bartlett, who is currently manager of Process Evaluation in the Nuclear Waste Technology Program Office of Battelle's Pacific Northwest Laboratories.

Prior to joining Battelle in 1969, Dr. Bartlett was with Knolls Atomic Power Laboratory and later, the chemical engineering faculty of the University of Rochester. During 1968-69, he was full vice professor of nuclear engineering at Istanbul Technical University in Turkey; during 1973-74 he served as a Presidential Interchange Executive, assigned to the National Bureau of Standards. Since joining Battelle, he has had a variety of management assignments concerning radioactive waste management, and related technology.

Educated at the University of Rochester for his undergraduate degree, he took his Ph.D. at Rensselaer Polytechnic Institute.

"Nuclear Waste Management: Options and Implications"

JOHN W. BARTLETT, Nuclear Waste Technology Program Officer, Battelle-Northwest Laboratories

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Dr. BARTLETT: As has already been indicated to you here, my function today is to provide you an overview of what is a very narrow section of the spectrum of interest of this meeting. And it is the technology of waste management. The basis for my remarks today has already been referred to; that is what has been called popularly the Technical Alternatives Document.

The document officially is known as ERDA-76-43; I assume a good many of you are familiar with it. You'll notice by the title that we have a hard time explaining ourselves in a few words with few syllables. That's why we call it TAD instead of giving it its official title. The document itself comprises some 2,000 pages; we will not insist that they be made part of the record of this meeting. We have made a modest effort to interpret and boil down the contents of that document, and I would like to acknowledge, at this time, my co-author, Al Platt. A copy of our summary version of ERDA-76-43 is available to those interested.

What I'd like to do today is address basically three topics relevant to the technology of waste management. First, an overview describing something of the types of waste and the status of technologies that are used to manage them; secondly, bore in a little bit on high-level waste management; tairdly, address questions of final disposition of the waste.

I will begin with a brief overview of the fuel cycle and the wastes it produces. The general statement basically is that there are potentially a variety of wastes produced; they are produced with a variety of volumes, depending on which operation of the fuel cycle you're addressing, and the radioactivity content of those wastes varies considerably. The focal point for most people is the high-level waste, which occurs in relatively small volume but which contains over 99 per cent of all the radioactivity produced by all the wastes in the fuel cycle. The way we can look at this in terms of

the technologists who are trying to develop waste management methods is illustrated by considering two alternative fuel cycles: the so-called throw-away option and the recycle option.

Let's consider first the option of the throw-away fuel cycle. If we operate the fuel cycle in that mode, then the waste form is simply the spent fuel itself plus any wastes that might arise from the relatively few operations of the fuel cycle associated with managing that spent fuel; in other words, waste from storage basins and the like.

If we go through the reprocessing operation, then we get a spectrum of wastes that's associated with fuel reprocessing and the other recycle operations. Quite a variety of waste types result from the processing of the spent fuel and the management of the wastes themselves. To manage these wastes, we have four basic types of operations to consider. One of them is the treatment of the wastes, which we call, in their as-generated form, "primary wastes"; secondly, we have storage operations, thirdly; we have transportation operations; and fourthly, we have final disposition operations.

I'll address briefly all of these operations for all types of wastes.

The classifications of technology that are described in the IAD document are defined as "available" and "under development." There are two categories of what we call available technology: first, those that are in commercial use today, and secondly, those that are essentially ready for commercial use but simply have not been fully applied at this time. In addition to available technology, there are, of course, as Dr. Kuhlman indicated, other technologies under development.

The status of waste management technologies is such that we have the technologies available today, using the word "available" as previously indicated. The technologies are under development for gases simply because with past practice and requirements, it has not been necessary to capture the gases so there has not been emphasis on developing and making gas capture technologies available.

Now, I'd like to move into consideration of what some of the waste management options are and some of their implications in terms of the technology of waste management. I'd like also to consider the interactions of those technologies with such things as environmental impacts and a good many of the concerns that are being addressed at this meeting.

First, by way of example, we can consider some of the options for treatment of combustible waste. There are many alternative technologies that might be applied here. We can simply compact this type

of waste, we can put it through a combustion process, and we might recover transuranics after combustion. In other words, there are various alternative flow sheets--as we call them--various different operations involved in waste management we might apply, and various specific technologies associated with each of those options.

There are similar options for noncombustible wastes. These wastes are quite frequently things like equipment that's been removed from service; in other words, things that can't burn, including general process trash that is not combustible. Again, we have numerous options for management of these wastes and again, many technologies that might be applied.

Another waste form for which there are several treatment options are the chop-leach-cladding hulls. The treatment technologies differ from those for combustible and non-combustible wastes, but there are various process operations available to us.

The points I want to make in discussing these wastes types and the technology options are as follows:

First, there are alternatives in the approach you can take to managing the waste and there are alterantive technologies for the approach. The primary difference between the alternatives, as it turns out (and this is an assertion of sorts, because I haven't justified it to you), is that the waste form produced is the product of the operation that you apply to it. The differences in the waste forms that emerge from the different technologies are primarily differences in the degree of fixation of immobilization of the wastes. In general, what you do is increase the level of effort in the treatment technology in order to increase the degree of immobilization of the final waste form.

For example, one approach for high-level waste is to produce a calcine, which is a loose-flowing powder. Another alternative is to produce a borosilicate glass which is a monolithic solid. To produce the glass requires that you first make the calcine. The more immobile glass, therefore, requires additional processing operations.

The degree of fixation can range from essentially none, represented by discharge of the wastes as is sometimes done with gases, to which I might call extreme, where you've done just about everything you possibly can to immobilize that waste into a nonleachable form. The thing that you have to keep in mind is that the more extreme you are in immobilization, the more it's going to cost.

It's going to cost more in R&D, it's going to cost more in process operations, and it will increase the potential for exposure or existence of occupational exposure to radiation, because you've

increased the processing that exists. The net result is that you're paying in the near term for your effort that's being applied to immobilize the waste more strongly for the long term.

Another important point is that a good many of these operations, as you apply them, generate more waste streams. In other words, you generate more waste forms than you had initially. You frequently generate effluents that you did not have before.

An example of this is provided by the combustible waste. As I mentioned before, one of the alternative technologies is simply to compact it. Another alternative technology is, of course, to burn it. If you burn it, you produce off-gases. The off-gases may be totally innocuous, but you have produced another waste stream and you have introduced effluents to the environment. So the thing we have to keep in mind from the technical point of view, with respect to these options, is that there are trade-offs of this type, and that the impacts can extend well beyond just the technology and any simple cost-benefit analysis you might apply to the economics of the technologies themselves.

I'd like now to extend these concepts to some of the options that are available for solidification of high-level waste. In doing so, I'll move into my second area of discussion, which is some of the technologies that are available for the management of the high-level wastes.

There are different technologies under development in various countries, including the U.S., and what I'm going to do is focus on one of those, called the spray calciner/in-can melter combination, which is being developed at our laboratory at Battelle Northwest. Conceptually, the process operates as follows:

Liquid high-level waste is brought into the system at the top, vaporized, and converted into a powder. Glass-making material is added to it, and the mixture is dropped into a canister which is encased in a furnace. It's a very unusual furnace, because it can both heat and cool in several zones. The reason for this operation is that as the material drops into the furnace, it is essentially a dry powder and you want to make it glass so you have to heat it and melt it.

After you've made the glass, you want to freeze it, so you have to cool it. The system therefore is designed so that you actually get a rising level of solidified glass in the container. The process also produces off-gases, and since it is one of several options for converting liquid high-level waste into a solid, it is subject to trade-off evaluations such as I previously discussed. Existing equipment has a capacity comparable to small-scale industrial operations.

The product from the spray-calciner/in-can melter is a monolithic borosilicate glass. With present plans for high-level waste management, the glass would be cast in stainless steel cylinders approximately 10 feet tall and one foot in diameter.

One possible extrapolation of the technologies that we have available is to make an effort to combine all the waste forms into a simple single waste form, wherein we have incorporated all the wastes of concern that we might be intending to send to geologic isolation. We have conceptual processes by which we could take these various waste types and put them ultimately into one container. Conceptually, such consolidation is possible; it's a potential target for the technology of waste management and one that we are keeping in mind.

Now, let me move to geologic isolation or storage and disposal options. The basic options that are available and were identified in TAD are geologic isolation and elimination. Geologic isolation can be accomplished with either a storage or a disposal mode.

The distinction between those is that when you emplace waste for storage, you at least allow the possibility with your technology for retrieval. When you emplace waste in a disposal mode, the technology you have used is such that you don't anticipate retrieval under any circumstances.

Storage in geologic media is illustrated by emplacement of cannisters into rock formations and metallic sleeves so that they can be retrieved. An alternative is to place the waste in a geologic formation so the waste is allowed to melt and mix homogeneously with the geologic formation. That would be a disposal type of emplacement.

The alternatives to geologic isolation are elimination techniques, and there are basically two of them. One is extraterrestrial injection, which involves rocketing the waste to a destination off earth. The other elimination alternative is transmutation, which is basically a process of converting the waste from one element into another.

I'm going to focus my remarks on geologic isolation because, as Dr. Kuhlman indicated to you, this is currently a mainline ERDA effort. We identified four possible geologic isolation environments, i.e., terrestrial environments into which the waste might be placed.

These include the seabed (there's a program actively investigating the feasibility of using the seabed as an isolation medium); ice-sheets; shallow continental formation, which is the technologist's phrase for burial grounds, and deep continental geologic formations. Dr. Kuhlman indicated verbally that we have many options within the United States that might be suitable for deep continental isolation. Maps in ERDA-76-43 indicate what they are and where they are.

The technology that would be used for emplacement in deep continental geologic formations is basically conventional mining technology. Dr. Kuhlman outlined for you how that technology would be put into operation. The point here is that putting technology into practice does not require any extension of past technology. All that is required is application of existing practice.

The concept that would be used in selecting and evaluating candidate waste repositories from the technical point of view is the concept of multiple barriers. The first line of defense, if you will, is the waste form; the second is any engineered structures that we put into the repositories, and the third is the geologic medium itself. The geologic medium is going to be selected to provide long-term stability, as Dr. Kuhlman indicated. This provides us an opportunity to consider alternative waste forms. If, in fact, we start with a geologic medium that is highly stable and highly nonreactive to the waste form or the engineering materials which might be present, then perhaps we have an option to select a waste form suitable for the entire system so that the three barriers perform satisfactorily together over the long term. The repository is a coupled system composed of the three barriers, and the repository system is coupled to the waste treatment system. The waste form has to fit the geology and the whole system then has to come together in terms of the technology you've applied from the moment of the generation of waste to the moment of final disposition. What we have to do is evaluate all alternatives on a systematic basis.

Many alternative waste treatment and repository systems can be conceived. One concept currently in the forefront because the technologies are well-known is to convert the high-level waste to a glass, put it into a metal container, and place the containers into salt formations. Current ERDA programs are, as Dr. Kuhlman outlined, aimed at identifying suitable salt and other geologic formations.

Evaluation of alternative disposal systems goes well beyond just the technical factors I've been talking about. The other factors involved in these evaulations are, in fact, the reason for this meeting. We have done considerable thinking about the other factors involved in evaluating candidate repository sites, and this thinking is reflected in ERDA-76-43. As we all well know, the factors involved go well beyond the purely technical, but in terms of the process that Dr. Kuhlman described of verifying for the long term that that repository is satisfactory, it does come down to technical factors such as evaluation of geologic, chemical, and mechanical stability of the system.

The other factors involved in selecting repository sites are primarily of concern to the initial selection of the site. This, of course, is where many issues and many people at many levels are involved. I will leave discussion of these issues to other speakers

at this meeting. I will focus on technical evaluation of long-term safety.

I'm focusing on long-term safety rather than operational safety because this is a subject with which many people are concerned. We have first to evaluate the stability of the repository in geologic time, and this, of course, reflects or is related to past history of the geologic medium. We also have to be concerned with the waste form stability and, as I've already indicated, this involves potential for interaction between the waste form and the geology selected. We also have to consider the capability of the repository to maintain isolation if the initial conditions should change throughout geologic time. All of this reduces to consideration of the possibilities that the radioactivity could migrate out of the repository under various circumstances. This can be, has been, and will be evaluated.

Still another factor to evaluate is chance for intrusion by man. In this case we are considering circumstances under which there might be intrusion of the repository, either accidental or deliberate, by human action at some time in the future.

The consequences of loss of geologic isolation are usually measured in terms of potential radiation dose to man. This can be done on an individual or population basis; there are techniques for making such evaluations. What we have to do is define specific applications of the techniques and the data in order to make assessments of the possible futures for candidate repositories.

There are really two things to consider when you're assessing the safety of a repository. One I call the action phase; the other I'm gong to call the prediction phase.

The action phase involves the things you actually do in the way of repository design and application of technology. These include waste treatment action; selection of waste final form; selection of the repository site, and the design of the repository, taking into account the geology, the waste form and all factors that are concerned with it.

Along with the action phase, we have the prediction phase. This involves the things we take into account in our predictions of long-term safety. The actual evaluation of future performance of a repository can be characterized in terms of four types of things that might go wrong. In other words, Murphy's Law might be applied to repositories in four categories.

These include, first, sudden natural events such as, for example, meteorite impact, that would disrupt the repository; and, secondly, slow, natural geologic events--such as faulting--that might disrupt

the repository. The third category includes events that occur because the repository exists. The important thing to consider here is this: the geology would be selected on the basis of its past performance--bedded salt that has been in place for hundreds of millions of years, etc. But once you create a repository, you've created a new system. You now have a system composed of a waste form and the geology, and you now have within that system thermal sources, mechanical stresses induced by excavation, and you also now have radiation sources. The question then is, how do those sources potentially, if at all, affect the future performance of that geology?

On the one hand, we assert and anticipate that the geology will not be changed. But the objective here is to evaluate any potential impact of the repository on the performance of that geology.

The fourth category of evaulation is concerned with probabilities and consequences of human intrusion. One can envision quite a spectrum of scenarios dealing with probabilities and consequences of human intrusion. One of the most common to consider, for example, is that of accidental drilling into a repository in search for other resources. You have to consider the probability that you would actually intercept the repository, the probability that you would intercept the waste in the repository (there are spaces between the canisters), and then the consequences of any interception. Are there large numbers of people affected? If so, how? Under what circumstances could large numbers of people be affected? Would the people who drilled into the repository and encountered it know what they did? If they have the technology to drill, do they have the technology to realize that they've intercepted a repository? Questions like these are being addressed in on-going safety assessment programs.

In summary, we are looking toward enhancing waste management technology and our understanding of how that technology would effectively be used in the basic technical decisions to be made. We are also addressing the fact that the technology fits within, and must be properly fitted within, that spectrum of concerns that are being addressed at this Conference. I certainly hope we'll do the job well. Thank you very much.

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Dr. CAMPBELL: We turn now to the people who have had a lot to do with the putting together of this Conference, the three session chairmen and organizers. They were selected by the intergovernmental committee and their outside advisors to provide help in organizing the contents and in selecting the participants in the sessions. Each will comment briefly on what his hopes are for the coverage of his session and on the basis of that, try to bring together some of the issues which will be addressed at those sessions.

I begin with the chairman of Sessions II and III, Laurence Moss. He is an environment/energy consultant, who has been an activist in his career in this field; he initiated a lawsuit, Sierra Club versus Ruckelshaus, establishing that the Clean Air Act required action by the administrator of the EPA to prevent significant deterioration of air quality. He was the co-founder of the Coalition Against the SST, and he has served as President of the Sierra Club. In addition to this, he is Chairman of the Environmental Caucus of the National Coal Policy Project, which is an effort on the part of leading environmentalists and industrialists to reach agreement, or at least to better understand the reasons for disagreement on key questions relating to the development and use of coal. I mention that, since, obviously, nuclear energy is not the only area of debate in the energy field.

Larry received his Bachelor's degree at MIT, as well as his Master's in nuclear engineering.

Remarks of

LAURENCE I. MOSS, Energy/Environment Consultant

Mr. MOSS: Thank you, Alan. As has been indicated, the session chairmen have been given a great deal of responsibility and authority in organizing their sessions. Accordingly, I think it's appropriate for me in these introductory remarks to briefly outline the framework within which I view this Conference.

I approach any discussion of energy policy and its elements with an environmental perspective. By that, I mean the perspective of one whose personal scale of values gives heavy weight to maintaining and enhancing environmental quality. This does not necessarily exclude other valid social goals. In fact, my listing of the goals of the national energy policy would include three that I believe to be of special importance. The first being. balancing supply of and demand for energy at a socially optimum level. Note that I said socially optimum level, not supply energy to meet needs or requirements. I think at the level of energy consumption we have in the country there's a great deal of discretion in energy use. And it's a matter of balancing supply and demand than meeting any absolute requirements.

A second goal I would list would be to reduce adverse social and environmental impacts arising from energy production and use.

And thirdly, I would list avoiding an intolerable level of reliance upon potentially insecure foreign sources of supply, and seeking to reduce any adverse impact arising from an interruption of supply.

Now, in making decisions about these things, and in addressing any important issue of technology in public policy, I strongly believe that it is society's responsibility to guide the implementation of technology toward desired social goals and away from undesired consequences. In other words, choices can, and should be, made. The field must not be abandoned to a kind of technological determinism. Alan mentioned my involvement in the fight against the SST. Probably the factor that motivated me most strongly in that campaign was this idea that we must make choices, and steer the development of technology. During my brief stint in government in 1968 and '69, I was surprised and dismayed that many officials who opposed the program for good economic, social and environmental reasons, did not believe it could be stopped. I resolved to do my part should the opportunity arise to demonstrate that choices could be made.

In making such choices, there is a proper role for analysis and a proper role for values. Let me use as an illustration the prevention of significant deterioration of air quality which is another issue I've been involved in. The analyst can estimate the decrease in visibility that would occur in a locality or a region as a result of additional pollutants put into the air. Evaluating the importance of a specific decrease in visibility--just taking one of the impacts that are possible--is a matter of weighing conflicting intangible values. That is a decision which we can only approach in a political process in which these competing values can be addressed in the process of making the decision.

Now, in such processes, I think that it is good to be aware of both consistencies and inconsistencies. For example, a decision that implies that social willingness to spend a hundred times as much money to save the human life in one area than in another area has with it a certain inconsistency that the decision makers at a minimum should be aware of. They may have reasons for making a decision like that, but the analysis should be made more explicit so that there's less confusion about the consequences of the decision.

I also think it's important that in implementing any decisions made by the social process, it's important to select those mechanisms which are likely to be effective and efficient in meeting the socially determined goals. We haven't always been very good at that. What I've said is, in my view, quite consistent with the application of logic to decisions in areas of social and technological systems. The weight given to values is not illogical. I was distressed, in contacting people for this Conference, that I would occasionally run into

a person who didn't want to participate because they felt that reason or logic had no part in the decisions that we'd be discussing here.

I think there's a confusion here as to what logic covers or doesn't cover. To my mind, it includes the weighing of values and intangibles. It would be illogical to exclude that in making any decision which impacted both beneficially and adversely on people, on different people.

To come to the specific subject of this Conference, some would say that the creation of nuclear wastes raises issues that are morally quite different from the creation of other wastes. They would say that there is no point in discussion, as at this Conference, concerning the management of what they perceive to be an immoral activity. I am not convinced by their argument. In fact, I think an analogy can easily be made between the creation of nuclear waste and the injection of carbon dioxide into the atmosphere from the combustion of fossil fuels.

Both have somewhat similar characteristics:

First, irreversibility. In the case of carbon dioxide, once released, control of it is lost. And in fact, if we burn all of our fossil fuels, it will be an estimated eight-fold increase in the natural background of carbon dioxide.

Second, they're similar with regard to the potential effect on future generations. The calculated time for carbon dioxide to decrease in concentration by one half to natural processes would be about a thousand years. So, we are making decisions now which very well could adversely affect future generations.

Third, the magnitude of the adverse consequences is very substantial. In the case of carbon dioxide there is the possibility of a climatological change which could result in either a warming or a cooling--no one really knows, which might produce a flooding out of the coastal plains of the world, or, loss through a shift to colder temperatures of much of the agricultural productivity of the temperate regions of the world. So, we're talking about an enormous potential physical and social consequence there.

In fact, perhaps, the chief difference is that carbon dioxide is routinely dispersed into the atmosphere with no attempt at containment, whereas, most nuclear waste is released only when and if technological and/or social systems break down. Further, the impact of most nuclear waste releases would likely be local rather than global. Thus, failures of waste management systems could probably be mitigated locally. With carbon dioxide, misjudging the consequences leaves us with only the possibility of global engineering of climatological

change in an attempt to compensate with all of the risks that that would bring with it.

In light of this, if we fear undue reliance on any particular energy supply technology, making it impractical to shift to another, for example, due to an inability to adequately manage wastes, then I suspect that our concern should be more with the fossil fuels which provide 90 per cent or so of U.S. energy, rather than nuclear power which provides about 5 per cent. Be that as it may, I believe that the decisions we can make now and in the next few years on both technical and public policy questions can substantially decrease the risk and improve the acceptability of nuclear waste management. That is why this Conference is particularly appropriate.

Glen Graves has described the role of the outside review group which I chaired. I am pleased that the interagency planning committee has implemented, with minor exception, our recommendations. I want to emphasize again that the session chairmen have been given great latitude in selecting authors, panelists and detailed topics for discussion. In my case, and no doubt in the case of the other session chairmen, I've attempted to select authors and panelists who cover a wide spectrum of views, including views with which I do not agree. I think you will find their ideas and discussions stimulating, thoughtful and provocative.

The recommendation made by the outside review group on the desired scope of this Conference I think is of some interest. What the group felt was that the Conference should have as its focus the waste management aspects of the post-fission parts of the fuel cycle. Where pre-fission aspects are clearly involved in an evaluation of post-fission alternatives, for example, the increase in uranium mill tailings, from a decision not to recycle plutonium, these could well be included. The management of waste from military programs, the group felt, should be included, since the exclusion of this topic would make it impossible to evaluate marginal risks and benefits of alternatives for the civilian program, or, to provide assurance that the total nuclear waste problem was being handled in a reasonable way. By the way, for those of you who are not in the "know," military wastes are referred to as ERDA wastes, in the jargon of the trade.

This Conference should be regarded as one step in an iterative process whereby important public policy issues are identified and resolved.

In the two sessions we will have on goals, we will address the question of how we will judge proposed social and technological systems for managing nuclear wastes. Would we know if an alternative was satisfactory? Or, if it was unsatisfactory? How would we know? The answer must include considerations of economic costs in relation

to the cost of alternatives; to the total cost of power; to the cost of risk-reduction opportunities and other areas. It must include consideration of social costs; of dealing with uncertainties; when should decisions be made; when do you have enough information to act. It should deal with distributional effects, who gains and who loses. Both within this generation and of cross generations. It should include public perceptions of risk and its acceptability. It should include questions of the legitimacy of whatever decision-making process is structured to make such decisions. And it should include consideration of the longevity of the institutions that will be responsible for the waste management.

I am looking forward to the discussion and I hope you are, too. Thank you.

Dr. CAMPBELL: It is a particular pleasure for me to introduce the next speaker, Mr. Ed Rovner, because he lives and works in a professional world very close to my own, and I know of the great respect with which he is held in that world. He is director of state/federal relations for the National Governors' Conference, and has for three years been director of the energy program of that conference. Obviously, a matter of tremendous concern to the governors across this country. He also has been director of economic development for the State of Maryland and an administrative assistant to Congressman Bingham, having been educated at Columbia for both an undergraduate degree and his law degree. His session will be devoted to considering organizational responsibilities and alternatives in this field.

Remarks of

EDMOND ROVNER, Legislative Director, The National Governors' Conference

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Mr. ROVNER: When I was first asked if I would chair one of the sessions, I misheard the topic to be discussed and I thought they wanted atomic energy, and I invited myself out immediately. It's been debated all over the country and I really thought this was not the time or the place to do it, shortly before an election where there were a number of referenda in a number of states. But then when it became clear what the topic really was, simply trying to focus people's attention on what the issues are in the handling of waste materials, I had a great deal more interest in the subject. I think there is a profound difference between being disinterested and being uninterested. The problem of being uninterested is the people who really don't focus

--you know that. What the society seems to be looking for is the classic disinterested man or institution that is going to operate only in the society's interest. I don't think it is likely that we can look for the classic disinterested party to come in and bring order out of what is not now chaos, but what is certainly not carefully structured.

What we are going to be looking at in our session are how to divide, if necessary, or to utilize institutions which permit responsibility to be assigned, which permit access and review of their work, and which are going to be able to make the modifications that time and technology will make wise and prudent.

We're going to be dealing, I hope, along the line with questions as to whether we should be looking at the licensing approach or an adversary approach. When I was in law school I used to confuse these two and I'm glad to say that the lines between them have become blurred, as to whether a party can intervene in somebody else's licensing application. I think that issue has been settled, but there is still the question as to whether we are looking at the technology people who are trying to decide whether an approach is acceptable versus the best approach.

The challenges arise at different points in the fuel waste cycle, as well. The first paper that's going to be presented will describe the fact that there are different decisions and there are different issues at different points in the whole waste management cycle; and perhaps different institutions ought to be operating at different points in it. The question is how can we devise institutions that make decisions in a private and public environment. Are these decisions to be made by the Federal government; are they to be made by the state government; made by the municipal government? How does a private venture operate in a field where he's dealing with a multiplicity of governments, which may change from time to time? We're dealing with decisions that are longer in term than any decisions that have been made by man up to this time. This is not like deciding whether to put the goal post on the goal line or 10 yards back or whether to have pointed shoes this year or next. It is not feasible to keep changing the rules of the game from year to year. These are long-term decisions.

The institutions that we have have never been assigned these kinds of long-term obligations. One question that came up in a side discussion this morning, is, where does the obligation come to this generation to protect another generation against its lunacy? If a thousand years from now people decide they want to dig these things up and incinerate each other or do other terrible things to each other, why do we have an obligation to preclude them from doing this?

What we will be looking at in the session tomorrow afternoon is really how appropriate are the institutions we have, for dealing with the problems of waste management; what changes, if any, ought to be made; and what institutions ought to be used for different kinds of questions that will arise. Thank you.

Dr. CAMPBELL: Our final session chairman to make comments about his hopes for his particular session is a fellow academic, Harold Green, who is a professor of law and director of the Law, Science and Technology Program at George Washington University, which, as you know, is in Washington, D.C. Educated at the University of Chicago, for both undergraduate and law degrees, Professor Green is the author of numerous publications on atomic energy law and policy, and public policy in general for science and technology.

He is chairman of the American Bar Association's Special Committee on Energy Law, and a member of the American Association of Advancement of Science Committee on Scientific Freedom and Responsibility. And finally, indicating the range of his interests, he is a founding fellow and director of the Institute of Society, Ethics and the Life Sciences. His session will be related to issues in implementation of nuclear waste, and I think one might well suggest that the issues meant here are issues related to ethics and...ethical and moral questions.

Remarks of

HAROLD P. GREEN, Professor of Law, National Law Center, George Washington University

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Professor GREEN: It's relatively easy to formulate goals for a nuclear waste management program and criteria for evaluating alternatives. Accomplishing the agreed-upon objectives is primarily an intellectual exercise in which reason and logic will lead to presumably sound goals and criteria.

It is much more difficult, however, to translate these goals and criteria into programs for their implementation. Implementation requires the affirmative action, or, at the very least, a passive acquiescence of public officials who are either themselves elected by the public or who are accountable to other officials who are so elected.

At our Friday morning session, we shall be considering this question: after we have developed goals that are broadly accepted, and criteria for evaluating policy alternatives, and after experts have reached considered judgments as to the programs that will best meet the criteria and achieve the goals, how can these programs be brought to fruition?

It's useful to consider the way programs for implementing radiation waste management goals will evolve. Various alternative implementation modes will be subject to searching analysis and compared with each other as to their relative advantages and disadvantages, that is, their relative benefits and costs.

Emerging from this analysis will be a kind of ranking of alternative options in terms of the cost-benefit balance. An alternative, or sometimes more than one alternative, will then become the program, or the alternative programs, to be considered for implementation. An assumption that this analysis is performed in a dispassionate spirit of absolute objectivity does not get us very far, since there is considerable question whether even the utmost objectivity can exclude strong influence from the values held by the assessors.

A principal difficulty in the radioactive waste management field is that the implementation of goals requires assumptions about the behavior of human beings, human institutions, human artifacts, and natural phenomena far beyond the pale of any prior human experience.

For example, if we know that, from experience, that a tank can be designed and fabricated to contain nuclear waste reliably for fifty years, there is necessarily some assumption as to what will happen to the integrity of the tank in the next fifty, or one hundred, or five hundred years. Similarly, can we really fully credit the assumption that because a geologic formation has been stable for the past five hundred million years, that it will be no less stable in the next five hundred years?

The technical experts may have a greater or lesser degree of confidence based on the experience and knowledge they do have on computer analyses, or on sophisticated research studies, but there remains almost always some residual uncertainties. Any cost/benefit analysis, therefore, must rest to some extent on the matter in which this residual uncertainty is interpreted and assessed.

The fact that the experts who perform the analysis are optimistic about how the uncertainty will eventually be resolved, does not mean that a pessimistic view is so much less rational, reasonable or acceptable that it cannot serve as a valid basis for a political decision.

There are, moreover, substantial moral and ethical issues. Just as politicians have at least in the last 40 or 50 years argued the immorality of saddling future generations with the service of a ballooning national debt, so may it be argued that it is immoral to saddle future generations with maintenance and service of ballooning quantities of radioactive wastes.

Others may argue that it is unethical for governmental policies to inflict on society the risk of genetic or somatic injury from radiation exposure that may be incident to the handling and storage of radioactive wastes. Again, the problem is the risks are primarily an incident of the lack of scientific knowledge in the experience as to the effects of radioactive exposures.

Our first speaker on Friday morning, Dr. Dean Abrahamson, will discuss the array of social, ethical and moral issues relevant to implementation of goals. Of course, we would all hope that the experts who develop, comment and recommend programs, have factored these kinds of considerations into their analyses. But even if they have done so, none could seriously contend either that these experts have a monopoly on social, ethical or moral wisdom, or that their own social, ethical or moral instincts are representative of those of the general public, at any particular moment. It's not inappropriate, therefore, that these social, ethical and moral issues be directly considered and debated by the policymakers and the public in connection with decision making on proposed implementation measures.

This brings us then to the question that will be discussed by Dr. Eugene Skolnikoff; that is, how the scientific experts who formulate and propose programs for implementation of nuclear waste management goals interact with the politicians directly involved, and with the general lay public that is indirectly involved in the decision-making process.

What should, and what will be the scope of the scientific, technical, social, ethical and moral questions that will be open for fresh consideration by the policymakers and the public? The answer to this question depends, in turn, upon the policymakers' confidence in the experts, and on the extent to which the experts attempt to either invite or alternatively to discourage consideration of these matters.

There are two aspects of the public policy decision-making process with respect to these goals that I think ought to be stated. First, even if we assume that there is a broad acceptance of articulated goals of a nuclear waste management system, the likelihood is that these goals will not be universally accepted. In any event, articulated goals, no matter how acceptable they are at any particular moment, may change as public values change.

Some government officials, some politicians, some others in leadership roles may even, while they are paying lip service to the goals, fight a rearguard action against them by trying to frustrate their implementation. For example, one would not be surprised if hard line opponents of nuclear power fight their battle by attacking the proposals for the effective management of nuclear wastes.

The second consideration is, that no matter how broad the support may be for the goals themselves, measures for their implementation may flounder when they impact on narrow concerns, interests, hopes and fears of particular people or groups.

The perhaps unhappy fact of the matter is that the implementation of nuclear waste goals lies in the vagaries of the political process in which multitudinous concerns and interests, relevant and irrelevant, rational and irrational, real and spurious, noble and selfish, must be given full consideration and wrung out, debated, ranked and compromised. Only the naive would expect the truth or objectively correct solutions to emerge from the political process.

My function this morning is not to provide answers, but only to set the stage. Perhaps Dr. Abrahamson and Dr. Skolnikoff will be able to provide us with some answers and our four panelists, representing a broad diversity of disciplined experience and viewpoint, will have useful commentary to offer. I do want to say that I'm particularly pleased to be a participant in this Conference.

In my opinion, the present plight of nuclear technology is directly attributable to the fact that the nuclear establishment has, for the past 30 years treated the important issues involved as being essentially scientific, to be resolved and served to the American public on the basis of faith in scientific authority.

It has, I believe, in fact, attempted to minimize the existence of social, ethical and moral questions, and in particular, the element of uncertainty in order to protect the American public from itself, from the possibility of incorrect decisions that may be based more on emotion than on reason. That kind of approach would serve primarily to frustrate and alienate large segments of the public and simply will not work in the present era of environmentalism, consumerism and skepticism about authority, generally. We hope this Conference represents a beginning of a new process to engage the public, to engage the hopes, fears and values of the public in the decision-making process. Thank you.

QUESTION AND ANSWER PERIOD

Dr. CAMPBELL: We begin now with questions. "Since ERDA has decided to pursue with determination the development and demonstration of geologic disposal of high-activity, solidified wastes, why confuse the public and provide ammunition for critics by alluding the possibility and by inference to the potential applications of such technically imprudent disposal methods as disposals in icepacks, or seabeds and extraterrestrial elimination? How much of an effort is ERDA devoting to the study of these technically imprudent disposal schemes?"

Dr. BARTLETT: In terms of relative order of magnitude, the effort devoted to the seabed disposal is about 1/30th, 1/35th, roughly, of the effort being devoted to the geologic isolation at this time. The assertion that they're imprudent, I would claim, has yet to be proven. They, in some cases, I think if you look into it, offer some potential technical advantage.

On that one, I would speak specifically to the seabed; it has some very useful characteristics in terms of looking just at it from a technical viewpoint. I'm not getting at issues of international law of the seas or anything of that type. I simply say from the technical point of view, it is well worth investigating and it's a part of policy, as I understand it.

I think Dr. Kuhlman should comment toward this, of keeping the options open, allowing the possibility that there are the things that may in the future offer equal, if not better benefit in terms of isolation.

Dr. KUHLMAN: If I could just add one thing to that, you recall that I said that the geologic disposal option was based upon a conviction that of the other alternatives that this was the only one that appeared technologically promising to the mid-80's. That statement implies several things. It implies an acceptance of nationally stated energy goals which I'm sure are not shared by some of you in this audience.

Most important, however, it is both the obligation of ERDA, as well as good common sense in a subject like radioactive waste management, that all practical options are discussed with the public; in this case, formally through the Environmental Impact Statement so that for better or for worse, the reasoning processes of ERDA

can be made available to the public in these other options as well as the geologic options which have been singled out for emphasis.

Dr. CAMPBELL: I have a series of questions now which I'm going to combine. They all relate to the disposal of defense wastes, and the question is, "Why has the consideration of the disposal of defense wastes not been included as a part of the program here?"

I will turn to both Dr. Kuhlman and Dr. Bartlett to comment on this. We simply say in passage that certainly the technical and social and economic and political considerations affect those that are involved with those wastes as well as with commercial wastes. The decision to talk about this in the commercial field, I think is related to what is the current policymaking situation which has to do with the Environmental Impact Statement.

Dr. KUHLMAN: I agree with the statement that the solution to the military waste problem is an equally important part of the radioactive waste management problem. There seems, however, to my mind, to be a reasonably authentic basis for separating the consideration, particularly at a meeting where one is concerned with the social values as we are here. The defense waste problem is a fact. It is a product of a 30-year legacy of programs which were constructed, with view to the national defense; it is an established fact, beyond, if you will, present day policy.

Now, the commercial nuclear power subject is quite a different subject in my mind. I think that the American population really does have an opportunity in the case of nuclear energy to address the question of whether the waste could be generated, whether nuclear power is a good thing and in addressing that question, obviously, one has to concern oneself, whether the waste can in fact be handled.

Now, ERDA does have a program for dealing with the defense waste issue. Technically, it is different. The time schedule is different. And for these reasons it seems convenient to restrict attention to the commercial side of this question for this meeting, in my opinion.

Mr. MOSS: At least in my session, on goals and criteria, there's been no attempt to limit the discussions to commercial waste and exclude the ERDA waste, and any of the panelists and authors who wish to talk about what they feel are relevant issues with the military waste are free to do that. I think that's true for the other session chairmen, as well.

Dr. CAMPBELL: It means the issue will in fact be covered in the substantive sessions of the Conference.

There are several questions here related to the international

aspects of the question..."How do we protect the U.S. public from nuclear waste generated in other countries?"

May I say, before turning to the panelists, to comment on this question, that I believe we have organized an evening workshop on the international implications of nuclear waste management, and for those with that interest, I would suggest you join that workshop. But, in the meantime, would any of the panelists care to comment on the relevance of the domestic problem to international implications?

Dr. KUHLMAN: I don't think that I am going to be able to give a proximate answer to that question. However, the ERDA waste management program does involve the establishment of extensive international cooperative effort. We have bilateral agreements with a number of different countries; we're participating in a number of multilateral efforts, such as sponsored by the NEA, the IAEA and other groups. It is recognized, I think, that each nation considers its basic handling of radioactive waste management problems as a national problem.

It is also recognized, I think, as was demonstrated rather vividly at the Denver meeting, that the commonality of waste management problems among nations has become increasingly evident. There have been several initiatives since the Denver meeting to examine the opportunity for more extensive international cooperation in this field.

Dr. BARTLETT: I can comment about the opportunities other nations have to do the kinds of things we're thinking about. First, to amplify on Dr. Kuhlman's comment about the interchange: what we are finding is we're all at about the same point in terms of having available or the state of development of the technology. And as I indicated in my slide in dealing with the alternatives for solidification of high-level waste, these are processes that are being developed really on a worldwide basis, and there's extensive interchange of knowledge about these alternatives.

I'd also point out that the United States today represents about 50 per cent of the world generating capacity. All the rest is distributed among all the other countries and it's about equal to our generating capacity--in other words, waste production--for the rest of the world.

Now, the other nations that are primarily concerned at this point, because they have operating reactors and are generating spent fuels, are Europe and Japan. The European nations share geology similar to ours. They have salt-domes, they have beds of salt deposits, and so forth. Japan does not and they're investigating alternatives for management of their waste. Basically, I can comment then that we're all at about the same point in terms of the technical base, and exchanging information on a regular basis.

Dr. CAMPBELL: We have several questions here related to some of the general comments concerning the decision process and the character of the process and the relationship of that to the ability to deal with technical issues. One question argues, "How can you have a discussion like the kind we're going to have here when you have differences in technical understanding among the participants?"

Another is directed to me in relation to the comment I made that informed opinions are better than uninformed opinions, and "...if that is the case, how do you conclude that technical solutions are in doubt when ERDA's Technical Alternatives Document, TAD, concludes that there are no unresolved technical problems, but rather, only development of the facilities and existing technology to handle nuclear waste?"

This question is directed mostly to Mr. Rovner and Dr. Kuhlman; it is assumed that consensus politics and disinterested agencies are in some way superior to an adversary process involving the acknowledgement of conflict and attempts of its resolution by political processes.

Mr. GREEN: I think the proposition that the lay public is incapable of understanding enough about the scientific and technical issues to participate meaningfully in the decision-making process is largely a myth. Having said that it's largely a myth, I will add that I think it has been a very carefully cultivated and nurtured myth. I do think there is a problem in the public's understanding. I think that problem is to a substantial extent a problem in either the inability or the unwillingness of the technical experts to communicate in a manner, in language, or ordinary political discourse and discussion.

Now there are many other areas of public policy decision making that are probably just as complicated and just as difficult to understand as nuclear waste management. For example, the intricacies of Federal fiscal policy or tax policy, or what to do about unemployment, or economic areas, generally. And I think that surely no one would argue that those issues are beyond the scope of the ability of the public to participate meaningfully.

Mr. ROVNER: I never meant to suggest, if that idea got through, that I would opt either for licensing or adversary. As a matter of fact, I think the distinction between those two approaches has largely been blurred over the years and I think this might be very useful. What I did mean to suggest was that something in the nature of licensing might be appropriate for one problem and an adversary proceeding for another. This is something that I hoped would be looked at tomorrow. This is not one issue, but a series of issues, some of them interrelated, some of them tangential to each other. I guess the one thing that I do believe is that a single answer may not be the right solution

for the complex of problems in terms of the kinds of forums that are used.

Dr. CAMPBELL: Let me make a comment that the fact that ERDA may believe it has solved the technical problems, I would say that that solution obviously carries with it a kind of cost-benefit assumption which one may or may not agree with. And I would not, therefore, assume the issue closed because there is a belief that a technical issue has been solved.

In fact, were issues closed off for discussion because the technical solution had been found, there would be no reason for the Conference. The assumption is that there are other aspects of the consequences of such decisions, social, economic and political, which have an existence and a life and a meaning of their own, which also has to be taken into account. And the fact of the Conference and its sponsorship suggests to me that there are those within the government who are making these decisions, who also believe that there are such considerations to be taken into account.

Mr. MOSS: If we look only at the process of technical analysis, and neglect for the time being the very important question of the weighing of intangibles that I talked about in the political process, but looking just at the technical process, there's good reason to believe that the kinds of technical issues that are focused upon and even the kinds of determinations made in that analytical process are to a certain extent a function of the agency funding the process and the individual selected for it.

Therefore, the fact that one group of technical experts came up with one set of recommendations doesn't mean that every group of technical experts would have come up with identical recommendations. To me, this is an argument for more decentralized, dispersed technical analysis capability in which we invite redundancy in order to safeguard against surprise adverse impact.

Dr. KUHLMAN: I would like to remind us all that the NEPA process itself recognizes the validity of the points that have been made here. The Generic Environmental Impact Statement which will be put into the public arena next spring is another example of where another approximation of the points that have been made here will be attempted. One of the purposes of ERDA personnel and contractors attending this meeting, is to derive from this meeting a little better understanding of the full dimensions of some of the nontechnical decision items that need to be considered as part of the general decision-making process.

Dr. CAMPBELL: Turning from that rather broad discussion to two questions which are related to each other, about the waste disposal

process, let me read the questions and ask both Dr. Kuhlman and Dr. Bartlett if they would comment upon them. One is: "Nuclear waste disposal appears in the title of this Conference; it seems on the basis of earlier presentations, you've addressed yourself to waste storage. Are there promising technologies being explored or developed to detoxify, neutralize, recycle or otherwise deal with nuclear waste? Storage may ultimately be unmanageable."

And then another question: "What is the nature and level of effort of ERDA's nuclear waste R&D programs that are relevant to fuel cycles not dependent on reprocessing and recycling? More specifically, how much is ERDA spending on analyzing, researching, demonstrating the throw-away, tandem and other cycles not involving chemical reprocessing? Is this enough to ensure timely availability of a waste disposal system if there is no reprocessing or recycling?"

Dr. BARTLETT: With respect to technology for storage, these are readily available and one of the questions to be considered is which waste form are you considering storing? Let's take high-level waste as an example, either as a liquid before solidification, or as a solid after solidification. As a liquid, of course, we're talking about tank storage. And Dr. Kuhlman carefully used in his talk modern tank storage; this is a technology that's considerably different from the original technology that was used at Hanford, for example. Modern tanks are stainless steel, doubly lined, and very carefully constructed to be able to maintain the wastes safely in tankage for quite an extended period of time. The solidified waste storage concept is represented effectively by the retrievable surface storage facility concept. The technologies that are available for storing waste that way vary, because of the opportunities for using different media to cool the waste, if it is a high heat-producing waste.

A very general point to be made is that the technologies have been investigated in detail and are readily available, if it should be decided that they would be implemented. But as I indicated before, the question of what gets implemented is a function of many factors in the decision process in addition to just those technologies.

Dr. KUHLMAN: Let me answer the second question, then I want to add something to the first question. The second question was how much emphasis is being given to the throw-away fuel cycle. You'll recall on the first chart I showed that there was $60 million budgeted in the Presidential proposal for '77 commercial waste. Now, of that, approximately $34 million was allocated to the terminal storage part of the program. That was the program directed at the constructing of these deep geologic repositories. Now, that entire program is directly applicable to the throw-away fuel cycle. Now, if one goes to the throw-away fuel cycle and therefore, does not operate reprocessing plants,the need for the reprocessing technology

which is under development in anticipation of the reprocessing fuel cycle, will largely go away. So my answer to you is that the ERDA program does provide for the throw-away fuel cycle with the same emphasis as far as time and capability is concerned as it does for the reprocessing capabilities.

Now, the first question, I think, if I heard it correctly, was directed at how much emphasis is being given to techniques which in fact make the waste disappear from the earth. At the present time we only know of two ways in which that can be done, one involves so-called transmutation; burning the waste in a neutron flux. The other method involves shooting it into space with a rocket. Now, without going into details, you can find this dealt with in the TAD document. The experts that have examined these possibilities find that technology is not available for either of these two concepts, nor is there reasonable prospect that there will be by the mid-80's.

Dr. CAMPBELL: Let me follow up with a somewhat related technical question that is asked by a colleague from Canada, representing Environment of Canada: "Are there any plans to develop Generic EIS guidelines for the front end of the nuclear cycle, uranium mining and milling waste and uranium refining waste; if so, when? If not, why not?"

Dr. KUHLMAN: Well, the front end of the fuel cycle in this country is largely commercially operated and under the direction of the Nuclear Regulatory Commission. It has under consideration an Environmental Impact Statement covering at least part of the mining and milling operations but I would suggest you get them to answer that question. We do not have such plans under the present ERDA mandate.

Dr. CAMPBELL: Let me turn to another different type of question, which relates to a matter that's going to be of concern to a lot of communities in this country, and that is, where are the storage sites going to be? And I have a series of questions here, one very specific, saying, "I understand that northern Wisconsin is being considered as a potential site for nuclear waste storage. Can you give me any information you have on this, such as possible location and the reasons for this?"

I have a similar type question from the State of Michigan; another one from Wisconsin; and a general question: "How much influence will public, that is, local and state opinion have on selection of waste repository sites, that is, Michigan residents and others?"

Dr. KUHLMAN: First of all, let me say, I don't know where the sites are going to be. The program ERDA started the first of this month is a program for the first two years; it's going to involve a systematic search to locate appropriate places for such

repositories. We have said publicly that we do expect them to be in salt, and the primary candidates involve the Gulf Coast salt-domes, and something called the Salina Basin which involves a number of states, including Michigan, Ohio, Pennsylvania, New York, and quite honestly, I don't remember whether it creeps over into Michigan to Wisconsin. The program will be taking form with considerable public interaction over the next two months. One of the very important features of the program will be a very early establishment of a liaison with those states who play any role in this program from the beginning.

Now, as I pointed out, there's a very large number of potential state candidates. The search for a specific repository location initially will involve many states who will not end up with a proposed repository site. Now the approach to this problem explicitly provides for the establishment of interaction with both state and local groups within the states. We expect the program to proceed from an initial screening stage to an actual location of candidate sites for a repository with continual interaction and advice from the states. It frequently has been debated whether this is solely a Federal authority to establish a repository. Whether it is or not, I think that it is quite clear that from a practical point of view, a repository program can be a reality only if there is reasonable acceptance and understanding of the states and local groups that are involved.

Dr. CAMPBELL: We're going to have time for only a couple more questions. Let me say in relation to that, that all questions become, whether used or not, a part of the record of this Conference; secondly, the questions will be gone over after the session and will be distributed to the sessions to which they are related, so those sessions will be able to deal with them.

Let me quickly ask a question directed to the technical people here as to the salt vault environment. And the likelihood of it being corrosive. "If spent fuel is disposed of directly as waste, what treatment of the spent fuel prior to the disposal will be required to assure the confinement of gaseous fission product?"

Dr. BARTLETT: Whether or not the salt is corrosive depends on the material that is put into it. Stainless steel, for example, is highly subject to what's called stress-corrosion cracking, which is initiated by a chloride in the presence of water. And in effect, the stainless would not be expected to last very long at all in salt; a matter of months, because the medium would be highly corrosive. Other materials this is not true of. This is simply a question, as I tried to indicate, of matching the materials to the environment. This has to be kept in mind all the way through.

With respect to the technology for spent fuel as the waste form, the objective basically would be, again, to create a canister compatible with the environment in which it would be placed. But then what do you do, if anything, in terms of the environment surrounding the spent fuel within that canister? There have been several possibilities considered; such things, for example, as filling the canister with helium, filling the canister with aluminum, or materials like this.

Dr. CAMPBELL: Thank you very much, Dr. Bartlett. I've just been handed an announcement that there will be a caucus of citizens' groups attending here, citizens' groups interested in the atomic energy program, in the corner of the room near the coffee tables.

And with that, we adjourn until the afternoon session. Thank you all very much.

Session was adjourned.

SESSION II: GOALS OF NUCLEAR WASTE MANAGEMENT PROGRAM AND SELECTION OF CRITERIA FOR EVALUATING POLICY ALTERNATIVES

MODERATOR: LAURENCE I. MOSS, ENERGY/ENVIRONMENT CONSULTANT

Presentation of papers by:

PAUL SLOVIC, Decision Research, Eugene, Oregon

WILLIAM BISHOP, Chief, Waste Management Branch, Nuclear Regulatory Commission

Panel discussion with:

BRANT CALKIN, President, The Sierra Club

EMILIO E. VARANINI III, Commissioner, Energy Resources Conservation and Development Commission, California

IVARS GUTMANIS, Director, Center for Resource Analysis, National Planning Association

LOIS SHARPE, Former Staff Coordinator, Environmental Department, League of Women Voters Education Fund

DAVID ROSSIN, Assistant Nuclear Research Engineer, Commonwealth Edison Company

IDA HOOS, Space Science Laboratory, University of California, Berkeley

Mr. MOSS: Let me begin by introducing the panelists. Brant Calkin has his academic background in biology. He's been an active environmentalist over 10 years, has served on various legislative and executive branch committees on both local and regional levels, and he is currently the National President of the Sierra Club. The club, as most of you know, has a policy position on nuclear power that includes a request that certain questions dealing with nuclear waste management be answered, and it's particularly appropriate that we have Brant here today to talk about criteria and goals.

Gene Varanini is a commissioner on State Energy Commission of the State of California. His educational background was with the U.S. Naval Academy and then later a Doctor of Jurisprudence degree from the University of Pacific. He is on the State Bar Environmental Committee in California, and served for nine years with the legislative branch of California, the California Legislature, as the chief staffer of the Energy, Resources and Land Use Committee.

Ivars Gutmanis did his undergraduate work at the University of Wisconsin, and the University of California, and graduate work at Johns Hopkins and George Washington University. His current position is as Director of the Center for Resource Analysis of the National Planning Association which is in Washington, D.C. He acts as a consultant for a number of organizations including the National Science Foundation, the OECD, Resources for the Future, and the United Nations.

Lois Sharpe has a Ph.D. in geology although she assures me she has not studied the geological aspects of nuclear waste disposal. She until very recently had served as the staff head for environmental programs in the League of Women Voters Educational Fund. She's been that since 1960. She's a most valued member of the FEA Environmental Advisory Committee which I've chaired for about three years now, and a member of the OTA Advisory Committee on the materials program of OTA.

Dave Rossin, from Commonwealth Edison Company, has his academic background in both nuclear engineering where he received as Master's from MIT, and in metallurgy where he has a Ph.D. from Case Western Reserve University. He is Assistant Nuclear Research Engineer with Commonwealth Edison Company. Before that he was with Argonne National Laboratories for 16 years involved in nuclear safety and environmental research.

Ida Hoos is a research sociologist in space sciences at the University of California at Berkeley, and the author of a provocative and stimulating book called "Systems Analysis and Public Policy." She's concerned with social aspects of technology especially those associated with the various energy options. She wants to look at, and in her research is looking at all of the implications and ramifications of these systems.

I will introduce Bill Bishop later, but for now I'll turn to the author of the first paper, Paul Slovic. Paul's background is in psychology, and his primary research interests are in the psychology of judgment, risk assessment and decision making. He spent 12 years at the Oregon Research Institute. He has very recently become a co-founder of a new organization, Decision Research, located in Eugene, Oregon which is devoted to the study of basic and applied issues in decision making. His interest in risk-taking behavior began with

laboratory studies of college students, progressed--if that's the right word--to research conducted in a Las Vegas casino, and most recently has focused on societal response to natural and manmade hazards. He has both Bachelor's and Ph.D. degree in psychology, Ph.D. from the University of Michigan.

"Psychological Factors in the Perception and Acceptability of Risk: Implications for Nuclear Waste Management"

PAUL SLOVIC, Decision Research, Eugene, Oregon

Mr. SLOVIC: My concern in this talk is with the determinants of public response of the risks of nuclear energy in general, and nuclear waste management in particular. The topic is a vital one.

Writing recently in the American Scientist, Alvin Weinberg observed, "As I compare the issues we perceived during the infancy of nuclear energy with those that have emerged during its maturity, the public perception and acceptance of nuclear energy appears to be the question that we missed rather badly." This issue has emerged as a most critical question concerning the future of nuclear energy.

Given the importance of the topic, one fact stands out: we know very little about the social-psychological factors, the goals, values, criteria, and so on, that determine public response to technological risk in general, or nuclear energy in particular. This is less because the problems in the area are tough, which they are, than because the time and effort applied to them has been miniscule. Part of this lack of attention results from the fact that scientists and policy makers have only recently become aware of the problem of public response, the societal risk. However, a flurry of recent research activity has provided the beginning of knowledge about the dynamics of societal risk-taking.

What follows is a brief review of that work organized around the following basic questions:

The first main question is: Is the human intellect capable of dealing with the problems posed by nuclear energy?

Second, what determines perceived and acceptable societal risks?

Third, what produces the present vehement and anti-nuclear sentiment?

Fourth, what do the answers to the above questions imply for the waste management problem?

Fifth, how can public values be discovered and factored into design for waste management system?

Making decisions about risky activities is difficult, and we may not be well equipped intellectually for the task. Acceptable risk appears to be directly proportional to perceived benefit. It seems like a rather trivial fact, but it can be very potent in understanding and predicting public response.

Nuclear power scores high, and all the qualities that lead to high perceived risks (benefits) are presently unappreciated. We cannot expect communication from a technical expert to allay the public's fears. An outstanding safety record or serious energy shortage could lead to public acceptance of nuclear power. Overall, the acceptability of nuclear energy is likely to be precarious subject to great fluctuations with the tide of events. There is a variety of techniques for assessing global and specific attitudes towards nuclear waste management. Such information could be valuable for systems designers and decision makers. Finally, the public wants to provide input into waste management decisions, and is willing to grapple with complex questions to do so.

Let's look at the problems of coping intellectually with uncertainty.

Energy decisions require high-level thinking and reasoning on the parts of experts and laymen alike. They require an appreciation of the probabilistic nature of the world, and the ability to think intelligently about the low-probability--but high-consequence events.

As Weinberg noted in the article to which I referred earlier, we accept on faith that our human intellect is capable of dealing with this new source of energy. Recently, however, the fact of those of us who study human decision prophecies has been shaken somewhat.

Consider for example, probabilistic reasoning. Because of its importance to decision making, a great deal of recent effort has been devoted to understanding how people perceive and process the probabilities for uncertain events. By and large, this research indicates that intelligent people systematically violate the principles of rational decision making when judging probabilities, making predictions, or otherwise attempting to cope with probabilistic tasks.

Frequently, these violations can be traced to the use of judgmental heuristics--which are mental strategies that will allow people to reduce difficult tasks to simpler judgments. These heuristics may be valid in some circumstances, but in others they lead to biases that are large, persistent and serious in their implications for decision making.

This isn't the place to pursue a full discussion of heuristics and biases, but I would like to mention one heuristic here because of its special relevance to energy decisions.

This is the "availability heuristic" whereby an event is judged likely or frequent if it's easy to imagine or recall relevant instances. In reality, instances of frequent events are typically easier to recall than instances of less frequent events, and likely occurrences are easier to imagine than less likely ones.

Thus, availability is often an appropriate cue for judging frequency and probability. But, since it's also affected by numerous factors unrelated to likelihood, reliance on it may lead to overestimation of probabilities for recent, vivid, emotionally salient, or otherwise memorable or imaginable events.

The notion of availability is essentially one of the most important ideas for helping us to understand the distortions that occur in the perception of low-probability and high-consequence risks.

For example, the availability notion implies that any facet which makes the hazard highly memorable or imaginable--such as a recent disaster or a vivid film such as "Jaws"--would considerably increase the perceived risk of that hazard.

My colleagues and I have recently collected data on perceived frequency of causes of death that shows the effect of availability bias. *(See Table 1.)*

We found that the frequencies of dramatic causes of death such as accident, homocide, cancer, botulism, tornados--all of which get heavy media coverage--were greatly overestimated relative to the statistical frequencies.

On the other hand, asthma, emphyzema, diabetes were among the causes of death whose frequencies were most underestimated. These diseases are relatively common in their non-fatal form, and their deaths are rarely attributed to them by the media. More recently we've been able to link an underestimation of frequency to the amount of newspaper space that is given to various causes of death.

What other psychological factors are likely to provide insight into the nuclear power controversy? Several results come to mind.

Table 1

Judgments of Relative Frequency for Selected Pairs of Lethal Events

Less Likely	More Likely	True Ratio	% Correct Discrimination	Geometric Mean of Judged Ratios [a]
Asthma	Firearm Accident	1.20	80	11.00
Breast Cancer	Diabetes	1.25	23	[7.69]
Lung Cancer	Stomach Cancer	1.25	25	[3.23]
Suicide	Homicide	1.30	32	[5.26]
Leukemia	Emphysema	1.49	47	[1.72]
Stroke	All Cancer	1.57	83	21.00
All Accidents	Stroke	1.85	20	[25.00]
Pregnancy	Appendicitis	2.00	17	[10.00]
Tuberculosis	Fire & Flames	2.00	81	10.50
Emphysema	All Accidents	5.19	88	269.00
Polio	Tornado	5.30	71	4.26
Drowning	Suicide	9.60	70	5.50
All Accidents	All Diseases	15.50	57	1.62
Diabetes	Heart Disease	18.90	97	127.00
Tornado	Asthma	20.90	42	[2.98]
Syphilis	Homicide	46.00	86	31.70
Botulism	Lightning	52.00	37	[3.33]
Flood	Homicide	92.00	91	81.70
Syphilis	Diabetes	95.00	64	2.36
Botulism	Asthma	920.00	59	1.50
Excess Cold	All Cancer	982.00	95	1490.00
Botulism	Emphysema	10,600.00	86	24.00

[a]Geometric means in brackets indicate that the mean ratio was higher for the less likely event. A geometric mean of [5.00] implies the mean was 5:1 in the wrong direction.

One is the desire for certainty. Implementing any new technology is a gamble of sorts. Like other gambles, its attractiveness depends on the probability and magnitudes of various gains and losses. Yet experiments have shown that people have a great difficulty making decisions even about very simple gambles, just with simple probabilities and payoffs attached.

Risk-benefit conflicts trigger anxiety. One way to counter this anxiety is to deny the uncertainty completely--if you're in a world that is perfectly safe, or at least safe enough so that you don't have to worry about the risk. This happens often with regard to natural hazards such as earthquakes or floods. With nuclear power, the opposite occurs. Risks are seen as so great the decisions to say "stop nuclear development" are easy.

When scientists explicitly point out the gambles involved in societal risk-taking, the decision makers and the public become upset. For example, just prior to hearing a blue ribbon panel of scientists report being 95 per cent certain that cyclamates do not cause cancer, Food and Drug Administration Commissioner Alexander Schmidt said: "I'm looking for a clean bill of health, not a wishy-washy, iffy answer on cyclamates."

Senator Muskie recently called for "one-armed" scientists who do not respond: "On the one hand the evidence is so, but on the other hand..." when asked about the health effects of pollutants.

Recently people all over the country have been demanding to know whether the swine flue vaccine is safe, and the way that they are asking about it makes it clear that what they're asking is: "Is it perfectly safe?"

The difficulty of facing life is a gamble contributing to the polarization of opinion about nuclear power. We could take some comfort in the possibility that these beliefs will be responsive to evidence. Unfortunately, even this solace is denied us by research showing the extraordinary perserverence of prior beliefs in the face of contradictory evidence.

Once formed, initial impressions structure and distort the processes through which subsequent evidence is interpreted. The reliability and validity of new evidence is determined by its consistency with prior belief. Contradictory evidence tends to be dismissed as unreliable, erroneous, and unrepresentative. Thus one's opinions tend to be invulnerable to challenges posed by specific bits of information confirming an opposing view or discrediting one's own beliefs.

Much more could be said about maladaptive mental tendencies, but

I think the point is clear.

Biologist Robert Sinsheimer has argued that the human brain has evolved to cope with certain very real and concrete problems in the immediate, external world, and thus lacks the proper framework with which to encompass many conceptual phenomena. People have faced decisions of great consequence like those involving nuclear energy, only within their recent history.

Following Sinsheimer's reasoning, it might be argued that we've not had enough opportunity to evolve an intellect capable of dealing conceptually with uncertainty. We're essentially trial-and-error learners, in an age where errors are becoming increasingly costly.

Now, I'd like to look at some facts about the determinants of acceptable risk.

Policy makers are being required now to "weigh the benefits against the risks" when making decisions about technological enterprises. The ultimate question they must answer is: "Is this product or activity or technology acceptably safe?" Or, alternatively: "How safe is safe enough?"

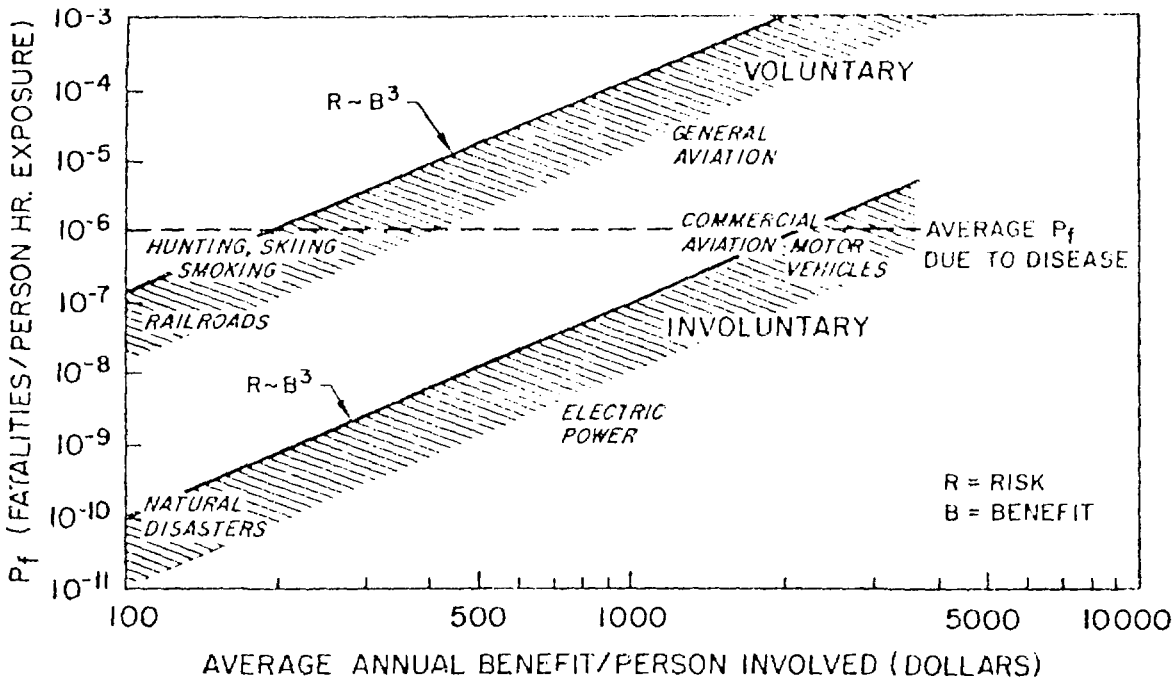
Casual attempts to answer these questions provide little insight. To understand why a community lives peacefully astride an earthquake fault or below a great dam--and shows little concern over housing a nerve-gas depot within its borders, but gets up in arms over a proposed nuclear power plant--requires greater understanding about the determinants of perceived risks and benefits than we now have.

There are at present two basic approaches to understanding societal acceptance of risk. One method advocated by Chauncey Starr is based on the assumption that society has already evolved or arrived by trial and error at reasonably optimal balances between risks and benefits associated with any activity.

Therefore, one can use historical risk and benefit data to reveal patterns of acceptable risk-benefit tradeoffs. Acceptable risks for a new technology is defined as that level of safety associated with ongoing activities having similar benefits to society.

The second approach employs questionnaires and psychometric surveys to measure the public's attitude towards risks and benefits directly.

Let's look a little bit further at Starr's approach which is illustrated by this figure which is quite well known. *(See Figure 4.)*



Risk versus Benefit, Voluntary and Involuntary Exposure
(from Starr, 1969)

Fig. 4

He has examined the relationship between risk and benefit across a number of common activities. You see plotted on the graph aviation, electric power, railroads...unfortunately only a few activities there. For risk, he looked at the specific expectation of fatalities for hours of exposure, and the benefit was assumed equal to the average amount of money spent on an activity, if it was a voluntary activity.

An alternatively equal benefit was assessed as the function of the average contribution that an activity makes to a participant's annual income. Obviously, the kinds of assumptions one makes in deciding how you measure benefits and risks here are quite vital, but from analyses like those shown in the figure, Starr derived what might be regarded as "laws of acceptable risk," namely, that acceptability of risk is crudely proportional to the third power of the benefits; and the public seems willing to accept risks from voluntary activities such as skiing, roughly a thousand times greater than it would tolerate from involuntary activities having the same level of benefit.

Starr's approach has the advantage of dealing with real behavior rather than attitudes, and thus provides the appealing solution to the problem of determining acceptable levels of risks.

There are, however, a number of serious drawbacks to the method. First, it assumes that past behavior is a valid indicator of present preferences. Second, it does not serve to distinguish what is best for society from what is traditionally acceptable.

Other critics have noted that risk is not adequately captured by indices that fail to consider quality of death; for example the fact that some lethal incidents are dreaded more than others. Or the impact of non-fatal incidents, or accidents or genetic defects.

Despite its limitation, Starr's approach is worth further study. My colleagues and I have felt that some of the questionable assumptions could be bypassed by using a direct questionnaire approach to quantifying perceived benefits and risks.

We have done a very preliminary study using members of the League of Women Voters as subjects, and my attempt is to illustrate some of the results from that. I don't mean this as any kind of definitive representative sampling study, but I think the results are informative.

We asked our League of Women Voters subjects to judge the present risks, acceptable risks, and present benefits of 30 activities and technologies as shown in the table. *(See Table 2.)*

In addition, they also rated each activity or technology on characteristics that have been hypothesized to influence acceptability of risk. Some of these characteristics involve whether the risk is

Table 2

Judgments of Benefits and Risks from 30 Activities and Technologies

Activity or technology	Perceived Benefit (Geometric Mean)	Perceived Risk (Geometric Mean)	Acceptable Level of Risk
1. Electric power	274	52	50
2. Prescription antibiotics	209	30	23
3. Vaccinations	194	17	20
4. Motor vehicles	187	247	42
5. Railroads	185	37	30
6. Fire fighting	178	92	60
7. Police work	178	111	66
8. Surgery	164	104	56
9. X-rays	156	45	28
10. Large Construction	142	91	56
11. Home appliances	133	25	24
12. Commercial aviation	130	52	40
13. Contraceptives	113	50	25
14. Pesticides	87	105	11
15. Bicycles	82	65	44
16. Swimming	68	52	50
17. General aviation	53	114	56
18. Nuclear power	52	250	9
19. Food preservatives	44	36	14
20. Alcoholic beverage	41	161	36
21. Skiing	38	45	43
22. H.S. & College football	35	37	22
23. Hunting	30	82	34
24. Power mowers	30	29	20
25. Motorcycles	29	176	34
26. Mountain climbing	28	68	69
27. Smoking	20	189	12
28. Spray cans	17	73	10
29. Food coloring	16	31	10
30. Handguns	14	220	13

voluntary or involuntary, when the consequences are immediate or delayed, whether it's known to those exposed, known to science, whether they're controllable, familiarity, whether they involve single fatalities or multiple catastrophic fatalities, whether they have an element of being common versus strict, and when a given mishap occurs how likely is it to be fatal.

These kinds of ratings were made for each of those 30 activities and technologies that are shown here. Very quickly to the results. We found that for many activities and technologies current risk levels were viewed as unacceptably high. The differences between perceived and acceptable risks suggests that our subjects were not satisfied with the way that market and other regulatory mechanisms have balanced risks and benefits.

There appears to be little systematic relationship between existing risks and benefits for these 30 activities and technologies. If anything, the relationship between the two, between perceived risk and benefits, is slightly negative as shown in this figure. *(See Figure 5.)*

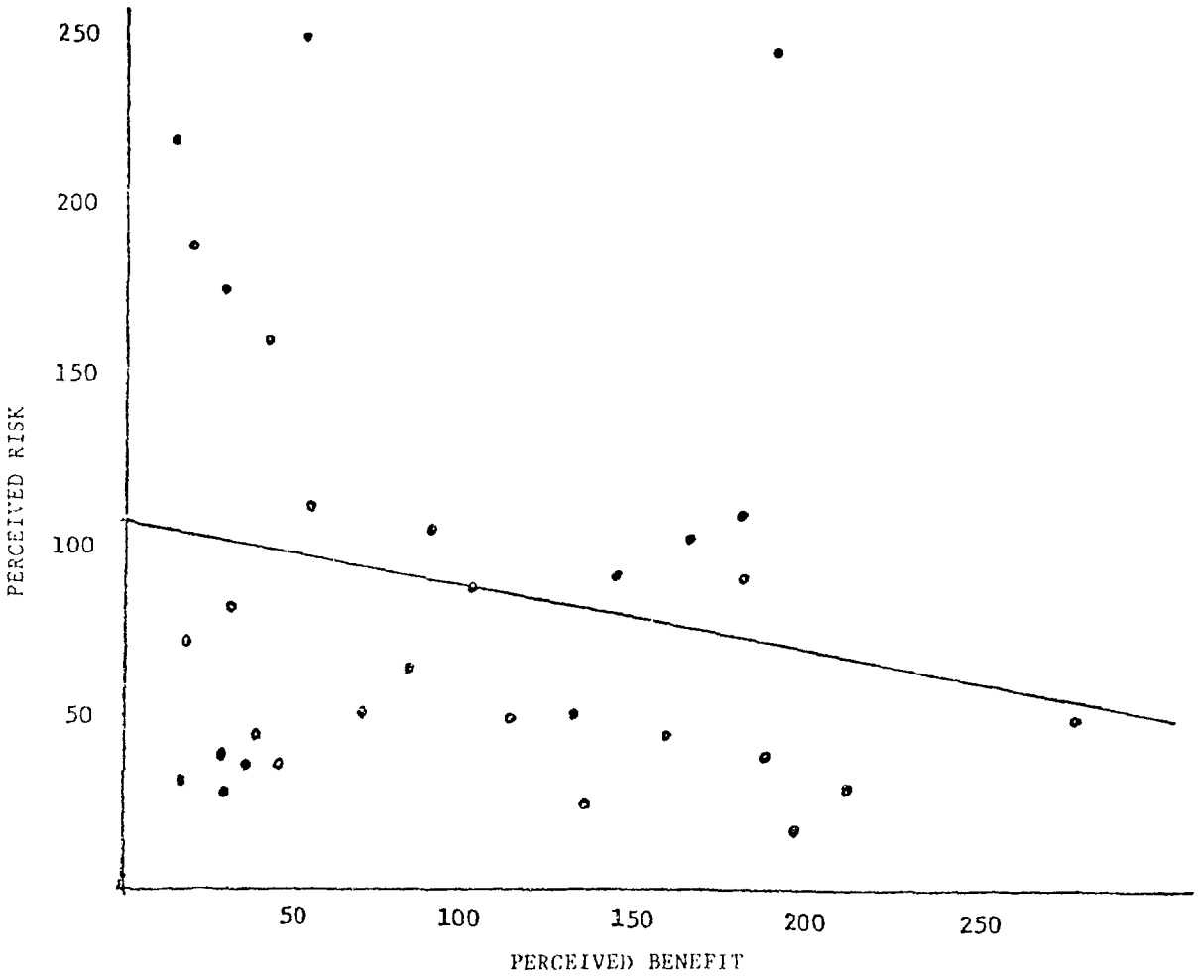
There appears to be a number of current technologies that have a high level of risk, but a low level of benefit such as alcoholic beverages, handgun, smoking, and motorcycles as well as a number of activities offering great benefit at relatively low risk, such as antibiotics, railroads and vaccinations. Again this is for a very special sample.

Okay, level of acceptable risk...this is all perceived risk... acceptable risk was quite uniform across the iterms, suggesting here that the subjects wanted the risks from different activities to be more equal than they actually are. *(See Figure 6.)*

Nevertheless there is also a consistent, but not overwhelming, relationship between perceived benefit and acceptable risk, such as Starr has hypothesized.

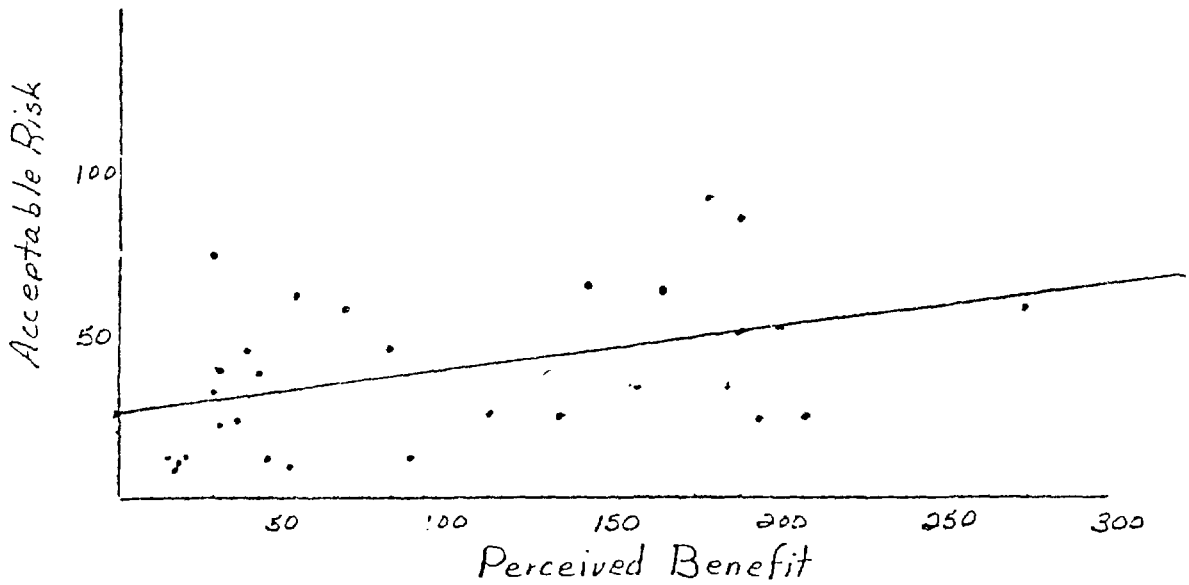
When we look at voluntary versus involuntary activities, *(See Figure 7)*, we divide these 30 activities up according to how our participants rated them on the degree of voluntariness, we find that as Starr predicts there is somewhat of a difference here. The level of acceptable risk is higher for voluntary risks holding benefit constant. Actually other factors mediate these relationships. We could have substituted here immediate or known or controllable or familiar risks. They all have the same impact in allowing for greater risk, given the benefit is held constant.

These nine characteristics of risk are highly interrelated, and they can be reduced by a statistical method really to two underlying



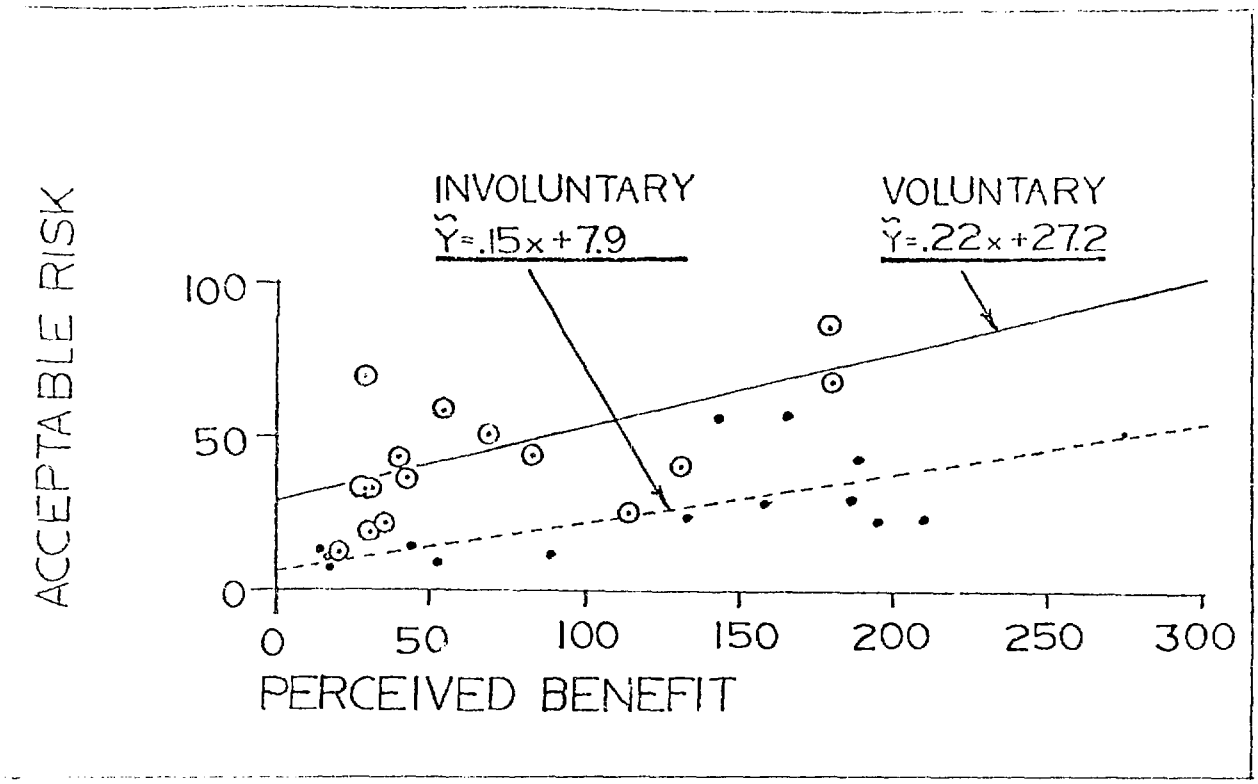
Relationship Between Perceived Risk and Perceived Benefit

Fig. 5



Relationship Between Perceived Benefit and Acceptable Risk

Fig. 6



Relationship Between Perceived Benefit and Acceptable Risk

for Voluntary (circled) and Involuntary Items

Fig. 7

dimensions of risk. *(See Figure 8.)*

Dimension one, which is plotted on the verticle, discriminates betwen high and low technology activities, with the upper end being characterized by new, involuntary, poorly known events with delayed consequences.

The second dimensions is one of "severity," which reflects primarily the certainty of death, given that adversity occurs.

We can fit out activities within a basic two-dimensional space which is a summarization of all these various risk characteristics. It may be that consideration of these two factors makes acceptable risks highly predictable. It may be that this kind of information could be useful in predicting public acceptance of risk levels associated with the proposed technologies.

Okay, let's look now about some of the implications of this for nuclear and waste management issues.

Why is nuclear power presently unpopular? The data I presented earlier gives some clues as to why the great opposition.

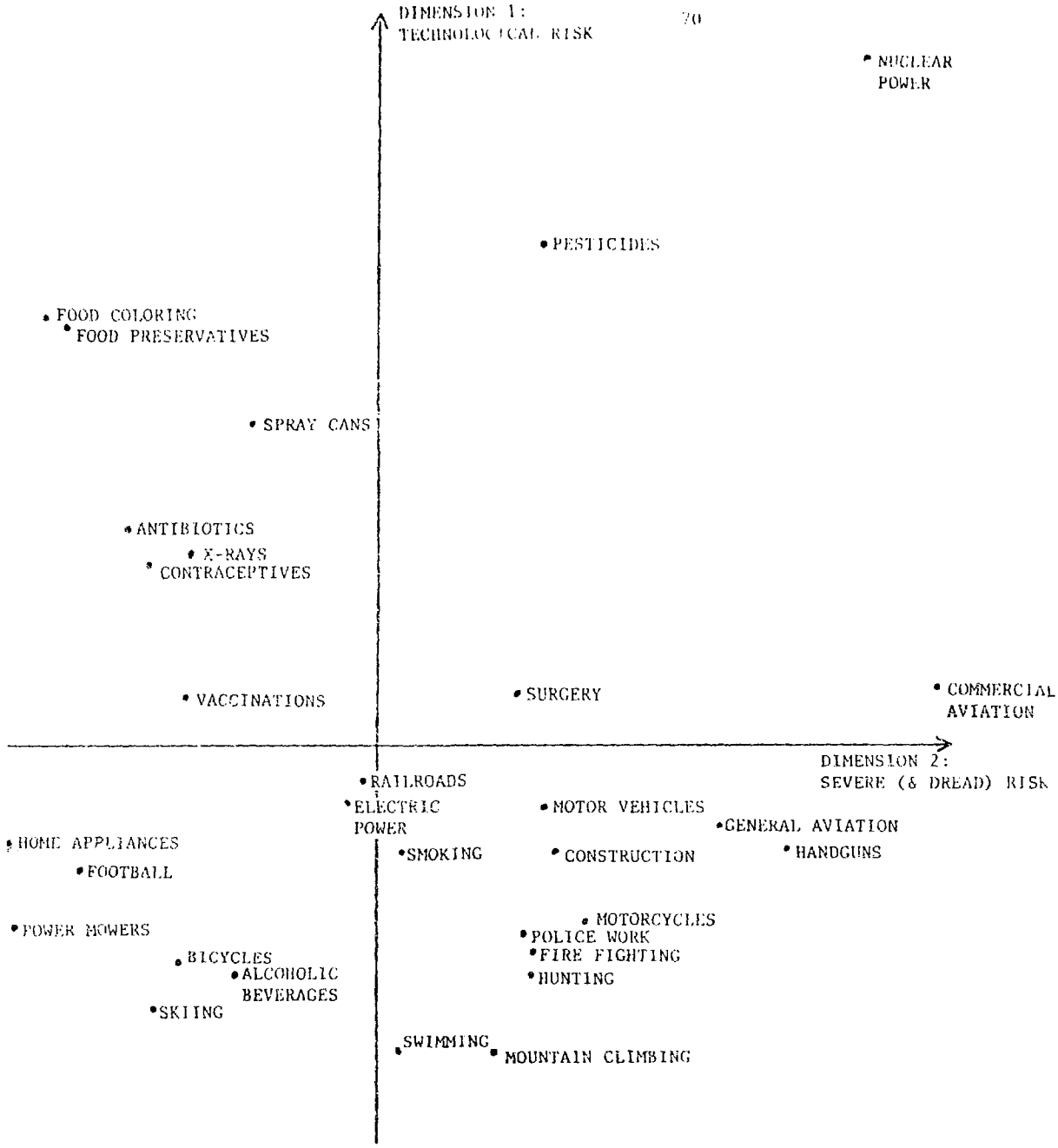
For one, its benefits appear unappreciated, being considered lower by our League subjects than those of home appliances, bicycles and private aviation. Perhaps this is because nuclear power is seen as merely a supplement to other sources of energy which themselves are viewed as adequate.

Second, its risks seem extremely high. Only automobile accidents, which take about 50,000 lives a year, are viewed as comparable. Why are nuclear risks so frightening? Nuclear power has the dubious distinction of scoring high in all the characteristics that stimulate risk aversion.

Nuclear power risks are also highly available, that is, imaginable and memorable, because of their association with nuclear war, and because their dread character leads to extensive media coverage which keeps them in the public eye.

Will nuclear power ever be acceptable to the public? I believe that any degree of acceptance of nuclear power could occur, ranging from vehement public opposition sufficient to topple a government--to rather placid acceptance of the sort now bestowed on X-rays and dams. Extreme public rejection is likely to originate from high-risk characteristics discussed above, and this rejection is likely to persevere for several reasons.

First, the low probability of nuclear mishaps makes demonstration



LOCATION OF RISK ITEMS WITHIN THE TWO DIMENSIONAL SPACE

Fig. 8

of nuclear safety difficult from a statistical standpoint. Any mishap will be seen as proof of high risk, but proof of high reliability would take a massive lot of evidence.

Second, as noted earlier, new evidence is likely to be distorted to confirm prior beliefs rather than modify them. Thus, for example, intense effort to reduce nuclear risks may be interpreted to mean the risks are great, rather than that the technologists are responsive to the public's concern.

Availability poses a further barrier to open objective discussion of nuclear safety. Availability effects may make it difficult to engage in objective attempts to discussing low probability hazards without at the same time increasing the perceived probability of those hazards. As one frustrated nuclear proponent has lamented, "When laymen discuss what might happen they sometimes don't even bother to include the'might'."

With all this working against it, how could nuclear power gain respectability? Response to X-rays and nerve gas provide some clues. Widespread acceptance of X-rays show that a radiation technology can be tolerated once its use becomes familiar, its benefits clear, and its practitioners trusted.

The case of nerve gas is even more enlightening. Certainly few human creations could be more dread, more potentially catastrophic than VX and GB nerve gases. When, in December of 1969, the Army decided to transfer these deadly substances from Okinawa to the Umatilla Army depot in Hermiston, Oregon, citizens of Oregon were outraged--except in Hermiston. Whereas public opinion around the state was greater than 90 per cent opposed, residents of Hermiston were 95 per cent in favor of the transfer.

Hermiston's acceptance of nerve gas illustrates the conditions under which a nuclear waste storage site might be tolerated, perhaps even welcomed by a community. For one thing, munitions and toxic chemicals have been stored safely at Hermiston since 1941, so the record was good and the hazard was familiar. Also, there were clear economic benefits to the community for continued storage of hazardous substances at the depot. Another benefit was the satisfaction of doing something patriotic for the country. And, finally, the responsible agency, the U.S. Army, was respected and trusted.

I have some comments now about one particular study which is directly relevant to the concerns of this Conference--a study of public attitudes and values associated with nuclear waste dispos[illegible] that was done at the Battelle Human Affairs Research Center in Seatt[illegible], its main impact is methodological, the first step toward potential facilitation of public input into decisions about waste management.

The Battelle study was based on questionnaire responses from 465 people, representing 22 different groups of respondents nationwide; these respondents were university students; junior high and high school students; professional, civic and religious groups; environmental activist groups; public utility employees; and scientists and engineers with backgrounds in nuclear engineering and physics.

There were really several questionnaires given out. One asked for the relative importance about four aspects of nuclear waste disposal, four key factors: short-term safety, long-term safety, cost, and accident detection and recovery.

A second part of the questionnaire had to do with what are acceptable levels on these dimensions. What would be acceptable increases in monthly electric bills due to waste management disposals, or what are acceptable levels of risk in short-term and long-term hazards. There was also a set of questions dealing with general attitudes toward waste management disposal, and then there was a chance for the respondents to critique the study and to give input about their own impressions of it. The study was preceded by a 15-minute film, which attempted to objectively present information about issues in waste management as background for the participants.

Three different techniques were used to measure the relative importance attributed to the respondents to the four factors associated with the design of nuclear waste disposal systems: short-term safety, long-term safety, cost, and accident detection. Although there were some small differences in the results produced by the three measurement methods, there was generally strong agreement among the three sets of results. *(See Figures 9, 10 and 11.)*

What we see is that long-term safety, short-term safety, and accident detection cluster relatively closely together as being most important. Cost was universally viewed as less important. The second section of the questionnaire asked, how satisfactory are various levels of these dimensions? We make an example using a cost dimension and this is just the mean result over all participants of a rating of acceptability. There were quite large differences between the groups, with nuclear scientists and environmentalists differing particularly on the acceptable levels of safety.

When the Battelle people looked at specific questions, attitudes towards nuclear waste, again there were large differences among the subjects, but overall we find several interesting results. *(See Table 3.)*

One is the fact that a substantial portion of respondents felt that costs should be of no concern. That was Question 3, shown here as the first question. Quite a few people felt loss of even one life

from nuclear waste is unacceptable. Question 18 is interesting. Many people felt nuclear waste should be stored outside the home region. Question 19 is interesting: the generation that received the benefit should take all the risks. Quite a lot of agreement on that. This was not in general an anti-nuclear group though, as Question 27 indicates. Only 7 per cent felt that the development of nuclear power should be stopped.

Respondents liked the survey. They felt that this was a good way of getting opinion, and they wanted to do more. This is just a first step. Many criticisms could be made. It does illustrate that getting the public involved with systematic questioning might provide information that could be valuable in a public policy context. Thank you.

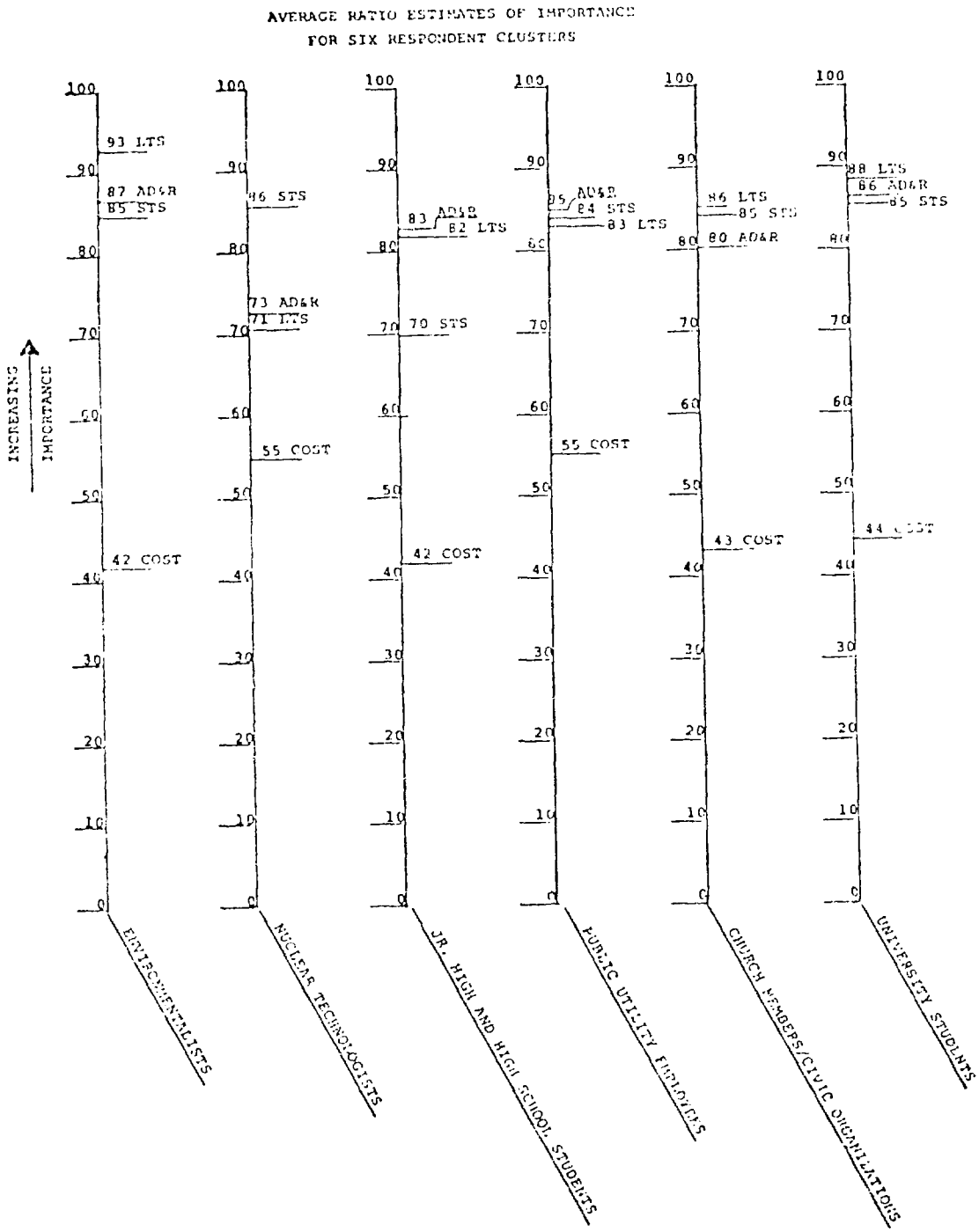

AVERAGE RATIO ESTIMATES OF IMPORTANCE
FOR SIX RESPONDENT CLUSTERS
INCREASING IMPORTANCE
100
90
80
70
60
50
40
30
20
10
0
93 LTS
87 AD&R
85 STS
42 COST
ENVIRONMENTALISTS
96 STS
73 AD&R
71 LTS
55 COST
NUCLEAR TECHNOLOGISTS
83 AD&R
82 LTS
70 STS
42 COST
JR. HIGH AND HIGH SCHOOL STUDENTS
85 AD&R
84 STS
83 LTS
55 COST
PUBLIC UTILITY EXECUTIVES
86 LTS
85 STS
80 AD&R
43 COST
CHURCH MEMBERS/CIVIC ORGANIZATIONS
88 LTS
86 AD&R
85 STS
UNIVERSITY STUDENTS

Fig. 9

ATTITUDES TOWARD NUCLEAR WASTE DISPOSAL FACTORS

Short-Term Safety

19. The generation that uses nuclear power should take all the risks for waste disposal.

28. The main concern of nuclear waste planners should be a safe system for the short term.

Long-Term Safety

11. Future generations must be totally safe from our nuclear waste.

29. Compared to other problems that future generations will face, nuclear waste monitoring is insignificant.

Cost

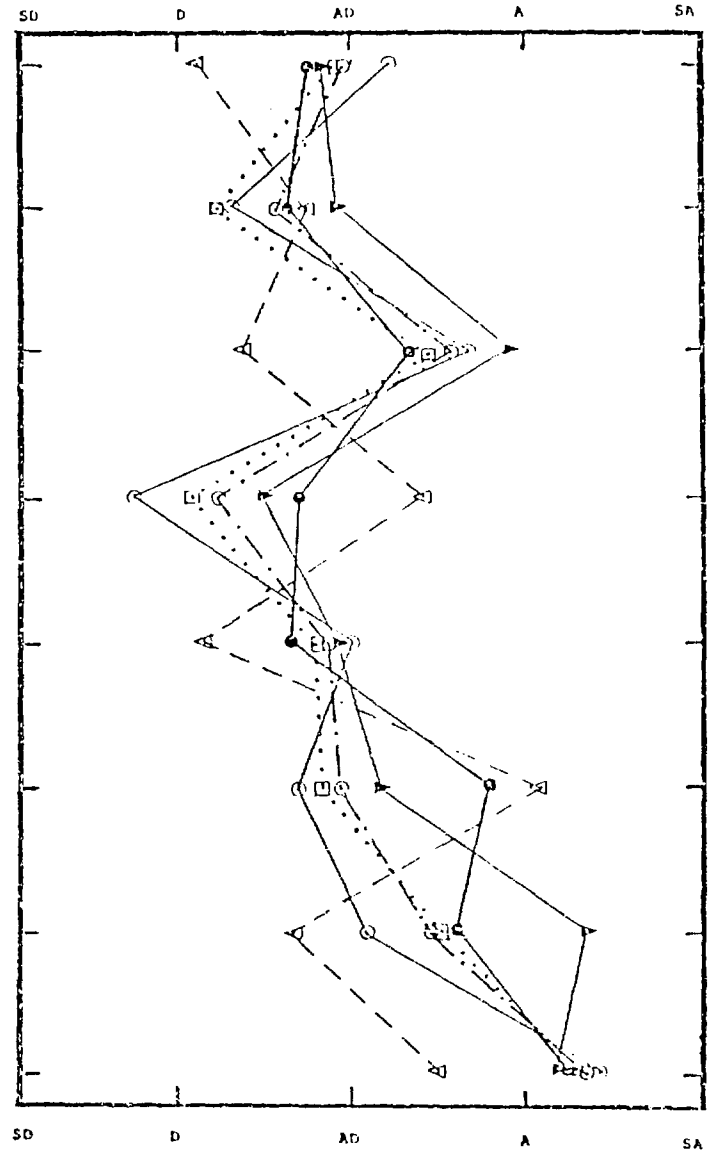
3. In dealing with nuclear wastes, cost should be of no concern.

25. To satisfy critics, the U.S. nuclear waste system will probably cost far more than is necessary.

Accident Detection and Recovery

2. Nuclear wastes should be disposed of in such a way that no one will ever be able to disturb or recover them.

15. Whatever disposal system is devised, there must be a way to detect leaks and recover the waste.



I. [illegible]

II. [illegible]

III. [illegible]

IV. PUBLIC UTILITY [illegible]

V. [illegible]

VI. UNIVERSITY [illegible]

Fig. 10

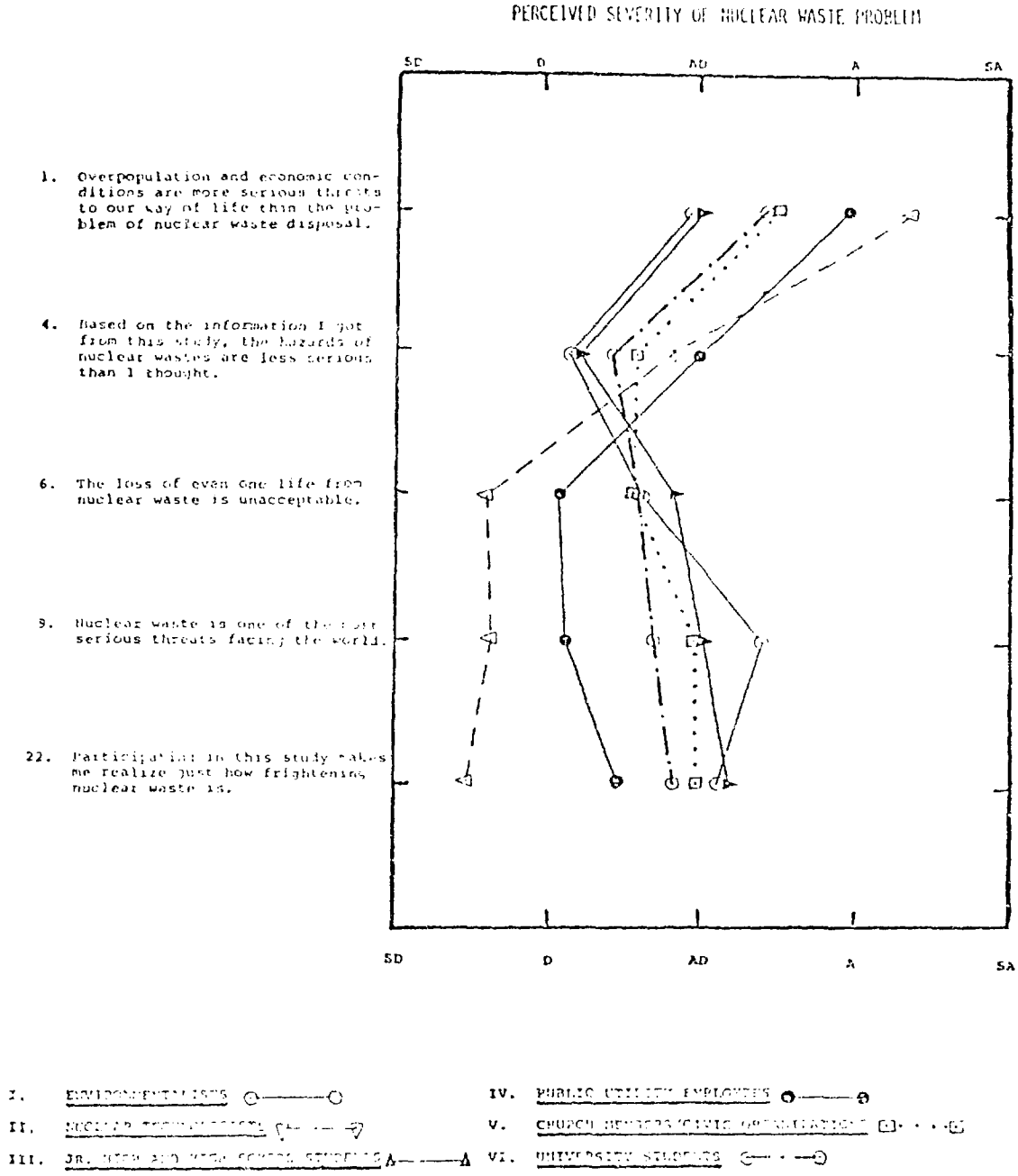

PERCEIVED SEVERITY OF NUCLEAR WASTE PROBLEM
SD
D
AD
A
SA
1. Overpopulation and economic conditions are more serious threats to our way of life than the problem of nuclear waste disposal.
4. Based on the information I got from this study, the hazards of nuclear wastes are less serious than I thought.
6. The loss of even one life from nuclear waste is unacceptable.
9. Nuclear waste is one of the most serious threats facing the world.
22. Participation in this study makes me realize just how frightening nuclear waste is.
I. ENVIRONMENTALISTS
II. NUCLEAR TECHNOLOGISTS
III. JR. HIGH AND HIGH SCHOOL STUDENTS
IV. PUBLIC UTILITY EMPLOYEES
V. CHURCH MEMBERS/CIVIC ORGANIZATIONS
VI. UNIVERSITY STUDENTS

Fig. 11

Table 3

Responses to Selected Attitude Questions for the Total Sample (from Maynard et al., 1976)

Question	Percent Indicating				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
3. In dealing with nuclear wastes, cost should be of no concern.	13%	21%	16%	40%	10%
6. The loss of even one life from nuclear waste is unacceptable.	7%	16%	17%	39%	22%
8. The construction of nuclear power plants should be slowed until an absolutely safe waste disposal system has been developed and thoroughly evaluated.	21%	32%	10%	26%	11%
9. Nuclear waste is one of the most serious threats facing the world.	9%	22%	20%	33%	16%
11. Future generations must be totally safe from our nuclear waste.	23%	37%	18%	17%	5%
13. The benefits of nuclear power more than outweigh the hazards in nuclear waste storage and disposal	12%	32%	20%	24%	12%
18. I would not want to have nuclear wastes disposed of in my region of the country.	21%	25%	19%	26%	8%
19. The generation that uses nuclear power should take all the risks for waste disposal.	11%	26%	17%	33%	13%
22. Participating in this study makes me realize just how frightening nuclear waste is.	7%	26%	24%	29%	14%
27. We should immediately stop developing nuclear technology as an energy source.	2%	5%	11%	39%	43%
28. The main concern of nuclear waste planners should be a safe system for the short term.	5%	21%	15%	46%	13%

Mr. MOSS: Are there questions of clarification from the panel? Seeing none, we'll go on to the next paper. Bill Bishop has a background in radiation chemistry. He received his Ph.D. in that from Ohio State University. He worked for a time at Sandia Laboratories on dosimetry and radiation effects, and on fuel cycle programs. For the last year or so, he's been with the Nuclear Regulatory Commission, and is Chief of the Waste Management Program, Office of Nuclear Materials, Safety and Safeguards. His paper is based upon a task force effort that he helped organize and which involved mostly people from outside the government, and Bill has agreed to report on the conclusions and recommendations of that task force.

"Goals for a Waste Management System: A Task Force Report"

WILLIAM BISHOP, Chief, Waste Management Branch, Nuclear Regulatory Commission

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Mr. BISHOP: When Larry first approached me to be a speaker on his program today, I in fact refused, but Larry persisted and eventually I agreed to do so. My reason for the initial refusal was that, as our general chairman said this morning, our intention with the program was to allow us government bureaucrats to listen instead of speak; and when I agreed, it was under the condition that I be allowed to try a difficult metamorphosis, namely, I want to remove my hat of the Nuclear Regulatory Commission and instead put on the hat of the task force reporter. So if you'll bear with me, I will do that (with this Figure):

THE VIEWS EXPRESSED HEREIN

ARE THOSE OF THE TASK-

GROUP MEMBERS AND DO NOT

REPRESENT THE VIEWS OF

THE U.S. N.R.C.

Fig. 12

It's an important distinction to make.

Our approach when asked what should be the goals for nuclear waste management was to set up a multi-disciplinary effort, and to

set out in a wholistic manner searching for what could be considered societal concerns, and seeking for places where the technology set interfaces and interactions with other parts of our social system.

There were seven of us on the task group. There was a research sociologist who is expert in systems analysis, a philosopher who also has a degree in geology, a political scientist whose specialty is government decision making, an economist whose specialty is nuclear policy, a lawyer expert in the making of national policy, a nuclear engineer who is expert in risk analysis, and me--a bureaucrat who once knew something about radiation effects on materials.

We began with what I feel is a simple thesis: that the goals are derived from societal concerns of one kind or another. We sought for those concerns in three places. We sought for them in the bases for programmatic directions, by asking program managers, "Why is your program taking that direction?" We found them in critiques of the nuclear program by asking why is that program wrong in that respect. And we found them also in a number of conventional wisdoms. So what you'll hear today is really not very much that is new, but is our own distillation of a number of things that we heard from a number of people.

The scope of our considerations was independent of waste type, but we found ourselves focusing often on high-level waste which seems to be the center of most of the concerns. The scope was independent of the authorities and organizations in the Federal government, and in the private sector. It was certainly independent of the types of technologies that might be applied. We found soon that it had to transcend our regulatory authority, although it certainly drew heavily upon that. It had to transcend technology in general, as I shall note later.

We tried very hard to confine our considerations to the waste management part of the fuel cycle, but often found ourselves drifting into the larger debate. We soon found that by starting with the technology that we were driven almost immediately to questions dealing with organizations which would implement the technology, and to the institutions (the laws and the customs) in which those organizations operate, and to society at large as a perpetrator of the institutions. But that wasn't all. We found soon that there were process oriented things that he had to consider, decision-making processes, the processes by which the society acts, and in fact the very implementation process for the technology.

So what we found was that the goals which we sought were really buried in a system which is almost circular and is clearly iterative in the way it approaches setting goals. The goals are a unique and singular articulation of this entire system and deal with the entire set of issues.

THE SYSTEM

→TECHNOLOGY IS USED BY

ORGANIZATIONS WITHIN CONSTRAINTS SET BY

INSTITUTIONS IN ORDER TO ACHIEVE GOALS SET BY

SOCIETY AT LARGE SEEKING

DECISIONS MADE THROUGH POLITICAL

PROCESSES LEADING TO

IMPLEMENTATION WHEN- -

Fig. 13

To organize our thoughts we found that the goals logically group themselves into three time regimes. *(See Figure 14.)*

If we consider that fission power is probably a finite energy source, sometime in the future we'll no longer be generating energy by fission; and no more waste will be produced beyond that time. Somewhat later we can conceive that society will for one reason or another stop managing the waste. And still further on in time (or maybe at the same time) there will be no more hazard or at least nothing that we will perceive as a hazard.

But, just as importantly, there was a fourth time frame, an earlier time frame in which the goals must be articulated and the system must be put in order and into operation.

An important point is that all of the goals for the later periods pertain also to the earlier periods.

So I shall cover the goal statements that we derived according to the time period to which they pertain. I will discuss each one only very briefly, which is going to put quite a burden on my colleagues on this panel to make me address them in more depth when necessary. These are in fact more a set of guiding principles which give a sense of the shape and size of the football field rather than a measure of the distance to the goal line. They are things that we think are important as guiding principles, and I shall touch on them all to give you an idea of the breadth of considerations we felt important.

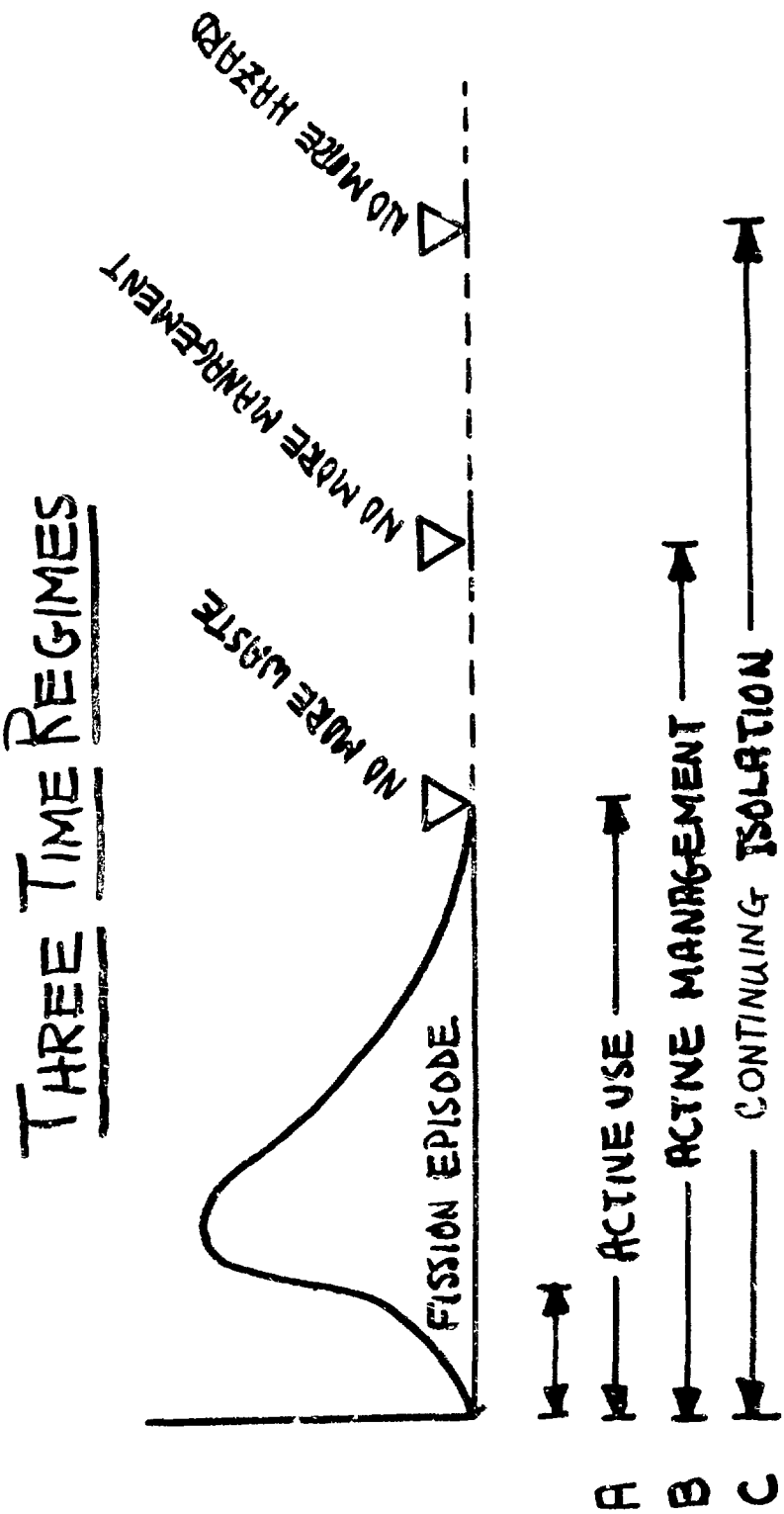
THREE TIME REGIMES
FISSION EPISODE
NO MORE WASTE
NO MORE MANAGEMENT
NO MORE HAZARD
A — ACTIVE USE
B — ACTIVE MANAGEMENT
C — CONTINUING ISOLATION

Fig. 14

In the early time frame of active use of nuclear power the goals are largely procedural. These are essentially in three groups. One is basing decisions and actions on the assessment of impacts--meaning all of the impacts. Decision making based on such assessments is done from day to day in the bureaucracy--or at least attempted--and we merely note here some of the important impacts.

They are the obvious ones of safety and environment, institutional arrangements, and organizations. They also include some non-quantifiable values about which you shall hear in some detail later in this Conference. We also found that at least today and probably for some time in the future that there will be some uncertainties.

Clearly this Conference itself and a lot of other Federal actions to date indicate an increasing awareness of the need for public involvement in the decision and planning process. Again, we derive a set of goals regarding this consideration. You heard this morning from Carl Kuhlman that the state, local and regional organizations are being involved in decisional processes now, and of course meetings like this and any other mechanisms are available for public involvement in the decision and planning process.

Finally, among procedural arrangements we found that costs really must be identified carefully. In economists' jargon a lot of things that are being externalized need to be identified; and resources for carrying out tasks or meeting those costs need to be assigned.

ACTIVE NUCLEAR USE (1)

- BASING DECISIONS & ACTIONS ON ASSESSMENT OF IMPACTS

  --SAFETY, ENVIRONMENTAL, INSTITUTIONAL, ETC.
  --INCLUDE NON-QUANTIFIABLE VALUES
  --MAKE UNCERTAINTIES EXPLICIT

- INVOLVING PUBLIC IN DECISION/PLANNING PROCESS

  --STATE, LOCAL & REGIONAL GOVERNMENTAL
  --PUBLIC PARTICIPATION

- ASSIGNING COSTS (IDENTIFY & ASSURE RESOURCES)

ACTIVE NUCLEAR USE (2)

- PROVIDING ORGANIZATIONAL FLEXIBILITY

  --RESPONSES TO CHANGES IN SCALE

Fig. 15 continues next page

--EFFECTS OF PRESENT NEEDS ON FUTURE SYSTEMS
--INDEPENDENCE FROM THE FUEL CYCLE
--ERROR DETECTION & CORRECTION

PROTECTION OF HEALTH & SAFETY

--MINIMIZE EFFLUENTS
--MINIMIZE PROBABILITY OF UNTOWARD EVENTS
--MINIMIZE TIME: CREATION--DISPOSAL

CONSIDERATIONS FOR TECHNOLOGY

--IMMEDIATE ESTABLISHMENT OF COMPLETE SYSTEM
--EFFECTS OF PRESENT NEEDS ON FUTURE SYSTEMS

Fig. 15

Still in the early phase of active nuclear use, there are three other categories of goal statements that we found useful. One has to do with organizations; and the key there seems to us to be flexibility in the organizations flexibility in responding to changes in scale. Clearly two automobiles on the road are more dangerous than one.

"Effects on present needs of future systems" expressed to us that there were two kinds of wastes: (1) the military and commercial which presently exist, and (2) those which would be coming from the next generation of fuel reprocessors. Our conclusion was that the needs for disposing of the present waste should not dictate the nature of the systems to be designed for the future wastes; and, in fact, the future management of military generated wastes should meet the same set of criteria we would impose on future generated commercial wastes.

We felt that because the fission episode was finite that there was a need to see that the waste management system was independent and could operate independently of the very existence of the nuclear fuel cycle. This can be dissected in some detail.

Finally, regarding organizations there is a need for detection and correction of error. This need is most important in the organizational aspects of the system, but you will see it again with regard to the technology.

Central in almost all of our concerns for waste management, of course, is protection of health and safety--the possible radiological effects. We found that the three central themes were: (1) minimize effluents (that is, minimize the amount of stuff that gets out from our activities in waste management and in fact make sure that the wastes themselves are not somehow reclassified as effluents), (2) minimize the probability of untoward events--that means to do things

carefully; you'll see later that this changes to a minimizing of consequences because probabilities approach one or become very unknown--and finally, (3) to minimize the times of some of the operations--for instance, that time between the creation of the waste and its ultimate disposition.

With regard to technology, we found two important aspects. One is a clearly stated need for an immediate establishment of an entire waste management system. This, of course, was the cause for the demise of the RSSF program. Again we see that the need for disposing of today's waste should not dictate the nature of the solution proposed for future waste.

The one procedural aspect which seems to carry on into the second time frame (the time frame where society is still actively involved in waste management--but is producing no more wastes) is that budgetary considerations should not be determining in the action of the system, that is, previous commitments of budgetary resources should be made.

Regarding organizations, again detection and rectification of errors are important, and for that purpose we note two things: (1) specifying the normal state of the system, what can we expect of normal operation, and (2) leaving documentation so that the future managers know what our actions were.

The National Academy in one of their recent studies pointed out that many implementing systems (bureaucratic systems) become self-perpetuating. We felt that was a caution that we could well afford to heed in designing a waste management system. And we felt that the waste management system should be in several ways independent from the political system; that is, it should not impose untoward civil liberties penalities, nor should it demand the particular kind of political system survive. It should not be dominant over the political system, rather subservient to it.

ACTIVE SOCIETAL INVOLVEMENT

- BUDGETARY CONSIDERATIONS NOT DETERMINING
- ORGANIZATIONS TO DETECT & RECTIFY ERRORS
  - --SPECIFYING NORMAL STATE
  - --DOCUMENTATION FOR THE FUTURE
- IMPLEMENTING SYSTEMS NOT SELF-PERPETUATING
- INDEPENDENCE FROM THE POLITICAL SYSTEM

Fig. 16 continues next page

. INTERNATIONAL CONSIDERATIONS

. CONSIDERATIONS FOR TECHNOLOGY

--INTERMEDIATE STEPS NOT PREVENT SUBSEQUENT
--NOT PRECLUDE RETRIEVABILITY

Fig. 16

International considerations are important and self-apparent, and I shall not elaborate further.

For the technology in this second period, we found two things important: first, the intermediate steps taken in the technology (such as transportation or solidification) should not prevent the subsequent steps that lead to the ultimate disposition, or in fact should not reduce the flexibility in those subsequent steps. Second, during this time frame, a statement that we heard often was that we not preclude retrievability of the waste during this period. Although we include this goal statement, we feel that more discussion and more thought is required in order to understand the importance of retrievability among the considerations particularly as opposed to the finality of disposal which we also find desirable for the later time period.

In the final period of concern, the period for which the system is designed to isolate the waste, the number of new goals that pertain becomes small. In the procedural area, we felt that to the extent possible siting and operation of the disposal system should not interfere with other resource values. The reason for this was clear. There should be no motivation for mankind to go back into the site, and unwittingly disturb the materials.

The system should not require an untoward stability of social institutions. As John Busterud mentioned this morning in his presentation, we cannot count on such stability.

The system should continue to comply with whatever radiation standards are set and met during the earlier phases. Facilities which are no longer involved in nuclear activities should be considered either disposal sites in their own right or should be decontaminated and released for uncontrolled use.

Finally, something that is important in this latter phase because society was no longer in control of the waste management system is that the disposal of the waste be permanent. Here we forsake easy retrievability.

I have kept some notes for you, and I'll review them here, because that was a large number of things to try to remember, and there are some key points that occur throughout. *(See Figure 17.)*

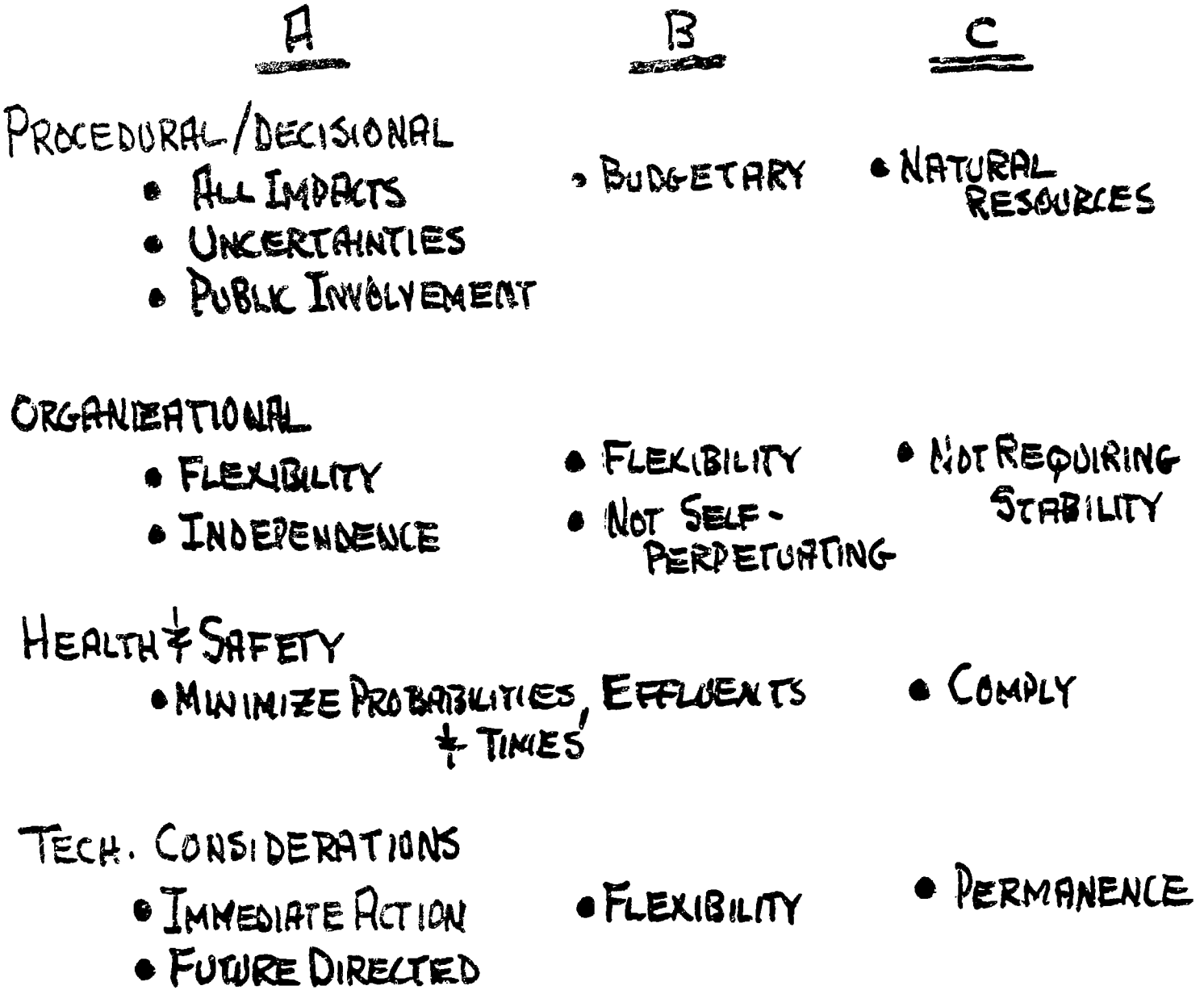
A
B
C
PROCEDURAL/DECISIONAL
• ALL IMPACTS
• UNCERTAINTIES
• PUBLIC INVOLVEMENT
• BUDGETARY
• NATURAL RESOURCES
ORGANIZATIONAL
• FLEXIBILITY
• INDEPENDENCE
• FLEXIBILITY
• NOT SELF-PERPETUATING
• NOT REQUIRING STABILITY
HEALTH & SAFETY
• MINIMIZE PROBABILITIES, EFFLUENTS & TIMES
• COMPLY
TECH. CONSIDERATIONS
• IMMEDIATE ACTION
• FUTURE DIRECTED
• FLEXIBILITY
• PERMANENCE

Fig. 17

IN PROCESS (TENTATIVE)

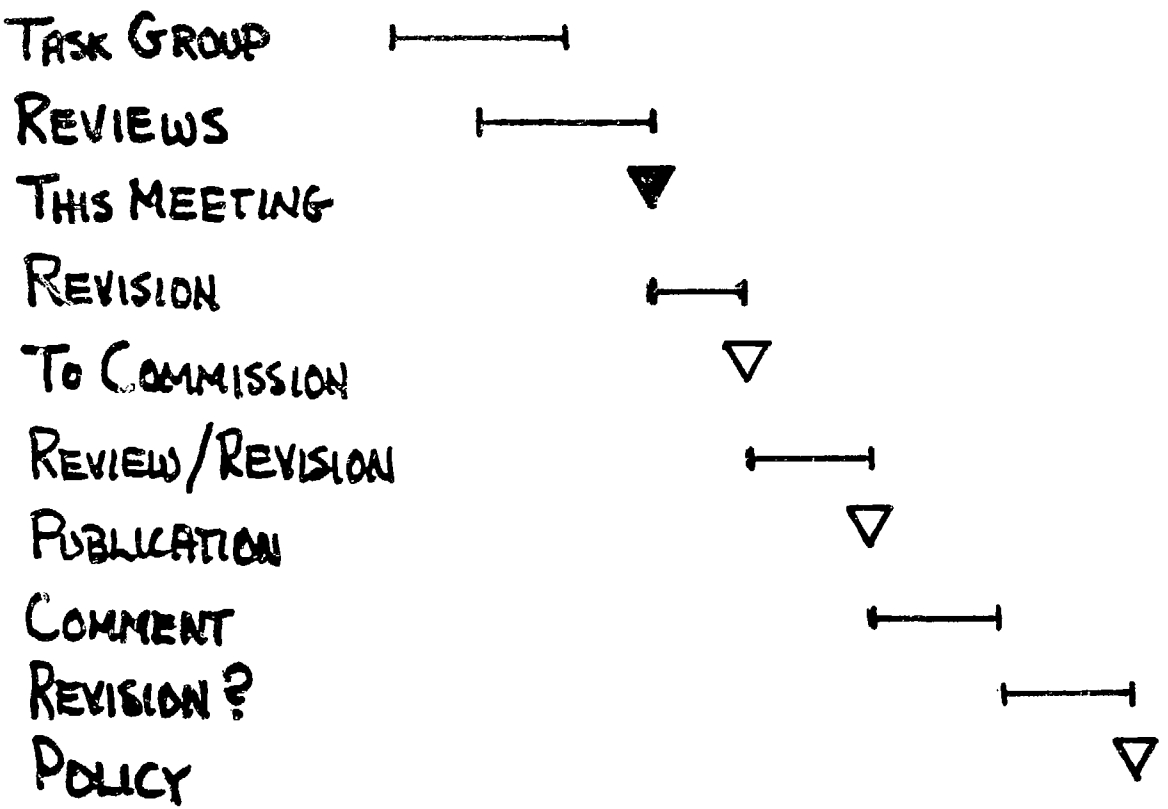

Fig. 18

In the procedural and decisional aspects, in the early phase the decisions should be made on all the impacts, the uncertainty should be explicit, and the public ought to be involved. What continues into the second phase are the budgetary considerations; and into the final phase, considerations for natural resources that might occur on the same site.

Regarding organizational considerations in the early two periods flexibility is key concept and independence should be maintained from some of the parts of our political system, and the organization should be designed so that it is not self-perpetuating. In the final phase, the key concept is that the system not require stability in the organizations and institutions. For health and safety, a minimizing of the probabilities through the first two phases is central, while in the final phase, by compliance with existing standards, a minimization of the consequences for untoward events is the thrust. For the technological considerations, there is an urging for immediate action, a consideration of flexibility in the system for the two first periods and then a permanence for the disposal.

Let me just very briefly remove my task force hat, and put back on my NRC hat, and tell you where this fits. The task group operated for several months. (There was a brief hiatus while I recently had a different assignment.) We went through a number of reviews and we're here at this meeting with an informal report to you. The report itself will go through another revision before we submit it to the Commission. The report will be from the task group to the Commission and not at that time an NRC product. After internal NRC review the task group report or some abstract of it will be published for comment in the development of a policy.

Figure 18 shows where my informal report to you today fits into the process of policy development--the decision-making process.

The task group began its activities last winter, about 10 months ago. If the time scales are usual it will be months before this sequence is completed, if not longer than that.

(See Appendix, for the preliminary statement of these goals, as handed out at the Conference.)

DISCUSSION PERIOD

Mr. MOSS: Thank you, Bill. Are there any questions or clarifications from the panel? Brant, did you have your hand up?

Mr. CALKIN: In Paul Slovic's paper I thought I detected a trend that I think was carried on in the next paper, and that is that the risks were perceived as being to people. They were personal risks.

The thing that I don't think was examined, or perhaps examined as elaborately, are risks to institutions and in the case of my special interests, risks to natural systems in which personal risks may be more or less. I think quite frankly there is another dynamic involved that may have been overlooked or at least treated too lightly. If people think that a risk is somehow going to affect governmental stability--if we're talking about institutions--or an entire ecosystem like the Great Lakes, that is a different perception of risks than how many doses am I going to get, or my neighbors or whatever.

Mr. MOSS: Paul, would you like to say something?

Mr. SLOVIC: Only that I agree that it's neglected and would be worth considering. I agree with that evaluation.

Mr. BISHOP: I'd like to respond very briefly. In our little group as we went around, we found very few--you're one of the first--who expressed the concern over the ecosystem except as those ecosystems impinge upon us as human beings. So yes, we sort of neglected them.

Mr. VARANINI: One of the things that I see in the proposed goals is sort of an admonition that Dean Acheson stated in "Present at the Creation," and that is if you raise the level of generality high enough, everyone can agree; it's when you come back from raising that level of generality to its operational impact that disagreement begins to develop.

Now our Commission has a substantially similar operation going on both in this immediate matter and in matters about energy futures in California. What we attempted to do, and what we came up with as a preliminary conclusion which is now going out to the public and then back to our Commission is a proposal planning for uncertainty; basically we see tremendous uncertainties with all paths to the future. We try to typify these paths as basically Jeffersonian or resource-oriented, Periclean or governmentally-oriented, or Western-development-oriented.

We proposed what we call a mixed-game strategy, but within that strategy we discussed economic and technological uncertainties with new energy sources and technology proposed, environmental uncertainties ranging from global climate modification to local air pollution health effects. [We found] a lack of consensus which makes it doubtful that any one strategy or viewpoint can gain the public support necessary for success.

Then we tried to move from that to some specifics. What do we really mean--rather than leaving the principles essentially ambiguous, and acceptable by all? We decided to enter the nether world of political policy and try to state what we meant.

First of all, we said we should hedge against uncertainties by avoiding dependence on any single technology or energy resource. There may be stability in diversity. We should avoid dependence on large single projects that delay our failure because of environmental opposition, or where difficulties in raising capital would have serious consequences.

We should avoid any large sources of pollution that have dubious or nonexistent practical pollution control technology that overload the environment, social or natural. While small may not be economical, it may be practical.

Then, finally, properly plan for and locate technology with reasonable potential for large disasters that could lead to loss of life and subsequent public reaction. Then we go on to set forth some essential action principles and recommendations.

It seems to me the real question here is what if these goals are unachievable, what do you do? Or, do you assume that they will be achievable, and that in the long run that engineering can make them work? Do you pause now, and plan out and try to validate what will happen, or do you basically proceed generally as we have in the past assuming that we can engineer our way through a variety of problems?

I think those are both valid points of view, and I think they both have been historically validated, given certain kinds of examples. That is the real dichotomy in terms of how to proceed.

Mr. GUTMANIS: In reference to Bill Bishop's paper, I have some mixed feelings about it, highly mixed feelings. To begin with, I have the benefit of seeing the paper.

I realize that this is very preliminary, in the process of some 14 steps. Four have been completed with 5 or 11 to go depending upon the schedule. It contains a total of 30 pages. Six pages are caveats or disclaimers.

Out of the remaining pages, 11 pages are general discussion, and then we have a total of 24 goals presented in a total of 10 pages. These goals purportedly are the basis or--to be quite specific- the benchmark and articulation of the program for waste management on which future things will be built. In 10 pages, 24 specific goals, each goal stated and then one or two paragraphs of comment.

Some of these goals are extremely interesting. Some of them are extremely controversial.

For example, in one of the goals the task force says the following: They are going to limit--mind you, limit--the emission of nuclear waste. I'd like to suggest that the public at the present time--not this public in this audience but the general public--still assumes (wrongly perhaps, but still assumes) there will be no discharges at all.

Here is a goal stated without any explanation to speak of. The explanation contains two paragraphs, or one paragraph only. Certainly and surely there has to be much more elaborate, much more detailed, much more thoughtful presentation of these goals before anything else.

As I gather from Bill's schedule, they go now before another meeting and then they go before the Commissioner. These are important issues we're facing, and certainly the content of this document does not reflect the importance.

Ms. HOOS: I want to express some ideas that were stimulated by Paul's paper, but that really are derived from having lived with Bill--if I may use that expression--during the goals exercise. Along with the psychological mechanisms that Paul has laid out for us so that we understand better how people make decisions under risk as the cognitive economies that people practice, it became very clear to us as we looked at how decisions were being made in other and similar areas that we could not overlook maybe what might be called not only the psychological mechanisms, but also the sociological mechanisms, which is to say the tenor of our times.

We're living in an era in which logical positivism prevails, and we seem to accept the quantitative methods, the kind of technical virtuosity that we're willing actually in most fields to separate from wisdom and we recognize and deplore it only when we totter off to retirement through a valedictory statement.

For example, when people retire as president of the American Economic Association, they make these statements about how they have sacrificed meaning to some kind of technical rigor.

We came to this rather early and that was when we began to realize that we really needed to bring in the social environment--even if we weren't always explicit about it, and even if we couldn't provide what is so dearly sought by the technical community; and that is something that they could handle in a quantitative way, because the whole social, political, and even economic environment for making decisions of this kind is a very messy one. It's intangible. It eludes these very treatments.

In fact, it's a little bit like the butterfly, because the minute you catch it it changes its characteristics.

It's interesting to have seen this at close range, because what we looked at, for example, was the way these decisions were made and the tools. We looked very closely, for example, at cost-benefit analysis; then at what becomes the future tense, risk-benefit analysis--really cost-benefit risk in the future mode.

We saw the kind of data that were brought in to justify a course of action, and we saw over and over again the playing out of the King Midas story; you could limit your vision in such fashion as to get certain results. It became awfully clear, really, the old adage that "whose bread I eat, his song I sing."

You could get almost anything out of any data--which made us realize many of the things that have been given to you in very synoptic form today by Bill; he has provided you with a distillation of a great deal.

If you look at the problems that emerge, it becomes very clear that one of the very basic issues is one that emerges all the time. We heard it this morning, and we heard it at noon. It's the issue of credibility.

Who is the expert to whom you ascribe credibility? That is a very interesting matter, and one that could take a dissertation on my part, but that's not why I'm here.

I must admit in closing that I think of W. H. Auden's statement, "When I find myself in company like this, I feel like a shabby curate who has strayed into a full room of earls."

Ms. SHARPE: I think that it's quite obvious that we travel and live in different circles, because my response to some of the things that have been said today are quite different.

I would of course commend the statement that's been made by practically everyone on the program that we must bring the public into this discussion if there is to be any successful completion of this program.

I do think, though, that the public is not experienced, and really not prepared for a risk analysis. I think that as ERDA moves along to specific site consideration and begins to deal with the people in those places, as I hope they will, they will find out that public officials are really not skilled in risk analysis.

The example that I would give you and is one which I feel I can

say, because it's in no way connected with the nuclear problem...a local public official said just the other day that his area had had the hundred-year flood this year, and they had the hundred-year flood last year, and now they thought they would be safe for the next 400 years.

Well, I think that the public simply cannot arrive at what is to them an acceptable risk determination. I think acceptability is really unknown. The risks as they perceive them are high, because the experience in this area is so new, because as was earlier pointed out--it's not going to be a matter of choosing to go skiing and running the risk. It's not even going to be a matter of moving into the flood plain below the dam.

If you even realize that that is a risk, it is going to be something that people are trying to bring to you where you are already located, in the location of these sites. Therefore, I think that it is simply impossible for the public to quantify at all the risks to which they might be subjected. I think their entire response to this has to be a kind of qualitative, intuitive response.

Mr. ROSSIN: Credibility is a key to this entire discussion, especially when the issues that the panelists and the speakers have raised concerning public perceptions and public acceptance are involved.

I want to make some specific comments and come back to credibility.

First, I also had a draft report to chew on before hearing those presentations, and I think Bill has reassured me as to one key aspect, and that is that the report is headed for a process and there is work left to be done. I found Bill's presentation--although I may disagree on various points--understandable, and while there were many generalities that have to be reduced to words, I found it something I could follow.

On the other hand, the draft document needs a lot of work because the words in many cases do not track what I read on the screen, and therefore I think the task force should work very hard on obtaining comments and obtaining a broader input at this stage of the review process. I've voiced this opinion before, but I'll say it for the record.

The group that worked on the task force was multi-disciplinary. This perhaps suggests that it covered a broad spectrum. I believe some key elements of that spectrum did not have sufficient input to that report.

I know my segments feels that it didn't, and I think it's

extremely important because, as was said a couple of times in this session, one of the questions we must face is: are the goals achievable?

Mr. Varanini made that point in some detail; what he said was a step in the goal-setting process, and one of the things that that report must face despite its being a state report and not a Federal action is that it has to undergo the NEPA process, the kind of process called for by the National Environmental Policy Act, the impact statement process, which really required weighing and balancing of many, many aspects. I think in that process a number of these goals will be shaken out, and the result after extensive discussion may correspond more to something that's achievable.

Back to the task force's report. I do think the wording is important, and I think that's why the ultimate product of the task force --not the final product but the product that goes to the commissioners for their consideration should be very carefully reviewed to see if the words convey the meaning that the task force intends to convey. As I say, I have reservations about that in its present form.

Some of the goals I would call suggested goals, because some are pre-judgments, and some have to stand the test of discussion. They are implied as goals that have been arrived at through a reason of process. I'm sure they have, but I'm also sure that more reasoning should go into the process before they get listed as goals.

One philosophical point that came up, and I discussed in this report, involves this question of reversibility, flexibility; I would submit that one thing that has to be included in the weighing and balancing--that is irreversible is delay.

The costs of delay are a key element in the Environmental Impact Statement requirements. All too often they're not included in the process. In many cases delay can be tolerated and in fact delay is very often wise. But it can't be ignored.

The impact of delay must be considered not only in the implementation, but in the effort to formulate goals, structure, procedures.

I would like to ask Bill to respond to a question. This is a specific. In the task force's effort I'm sure they must have considered and discussed from time to time the approach that ERDA is working on today, the kind of things that were presented this morning. I would like to know if the task force has any feeling about how the effort that ERDA is making stacks up with regard to the kinds of goals that they are thinking about?

Now, let me take up a key point that goes back to credibility

and to the spectrum of input in the task force report. I think ERDA has the entity that Congress has assigned to the job of developing a waste storage plant and the industry which obviously has the key role as the one who generates the waste that will ultimately go there, accept the burden of proof to prepare the analysis and to make the case for the system that will ultimately be used. I think that burden of proof is acceptable. Since we and ERDA really do have that burden of proof, I think they really do deserve a more integral role in the development of the goals.

Paul Slovic's presentation, which I found very interesting, comes back again to the question of credibility. Two of the most fascinating things about the information he presented are that there are many segments of the public; within those segments there's a wide variation, but statistics show one thing that fascinates the utility people here, and that is the perceived benefit of electric power versus the perceived benefit of electric power that comes from nuclear power.

This is a very, very important perception that comes out of that work which is maybe hard for many of us to understand, but there's an important message there that we have to think about.

The other involves the various groups that considered the nuclear issues, and the fact that nuclear technologists really did differ in their opinion to some degree. I guess the question that is foremost in my mind is: do they disagree because of their knowledge of the subject and the familiarity with it, or do they disagree because their opinion is somehow compromised by their background, their employment? I think this is what credibility is all about.

Ms. SHARPE: May I ask what do you mean by the perceived difference between electricity which is produced by nuclear plants and electricity that's produced differently?

Mr. ROSSIN: The benefits from those two. Let me turn it back to Paul, because he's the one who developed the data or is at least more familiar with this than I am.

Mr. SLOVIC: In our study we asked for people to rate the benefits from non-nuclear electric power as one of the 30 items. We also had them rate the benefits for nuclear power. Nuclear power was lower than the middle. It was in the lower half in terms of benefit, where electric power was one of the top. People do not value--at least in this sample--the benefits of nuclear power highly, and we don't really understand that. Maybe because they believe at present that there are alternative sources of energy. We really don't understand it, but it's quite a difference in the perceived benefit.

Mr. SHARPE: Maybe they just don't think they need a lot more

power, electricity. Maybe they think that the amount is adequate.

Mr. MOSS: I don't want to let the panelists off the hook too easily. I've heard that as we move from the more general to the more specific, disagreement is inevitable. I've heard that the public can't deal with quantitative risk analysis in terms of making value judgments. I've heard credibility is the key issue, but what I'd like to know: what course of action panelists would suggest in trying to overcome some of the problems that have been identified?

Mr. VARANINI: I'd like to make one comment before I start, and that is I find the document to be extraordinary in terms of its impact, and I think when you and the audience get it--if you get it apparently before it gets revised--I think you'll share that same interest.

For example, the burden of proof in order to deploy a technology is being placed on the proponents of that technology. Just stop and think about that for a second; where would be be today in terms of technology if that were the case? If we change this burden of proof, as I believe we must, what does that mean in terms of uncertainty with an industry and capital market?

The second thing is that the basic Euclidean axioms are contained on one page each so this may be plenty pithy in terms of content once you read it, but I'd like to make an institutional comment. We talked about fear, whether that fear is rational or irrational, and how to resolve it, and the fact that the public is concerned. If you couple that with making technology bear the burden of proof, it seems to me that the first point is that you want to institutionalize the capability to allay the fear; and that's credibility within the government institution and includes its past record, and whether it's basically a regulatory mechanism or advocating mechanism.

Then finally, perhaps the technology ought not to be deployed any further, at any further rate of acceleration, until that burden of proof is resolved or validated.

Now, in California, the legislature has established that as our method of operation. Basically, we have a moratorium on. Until we can make certain validations of Federal action, at least in theory, no new nuclear power plants will be sited--subject, I'm sure, to litigation and a whole series of assumptions piled into that. But that has the public credibility in the sense that the technology won't be--the rate of deployment won't be--increased until certain things are resolved. That resolution has been bumped back to our legislative body--for perhaps further excoriation in terms of where the commission's credibility has been lately--but in any event, we have two diverse institutions attempting to validate, from a general point of view, the technology.

No matter how the decision comes out, there's always going to be a body of people, whether they are "the public" or whether they are people in industry, there is always going to be a group of people who would feel dissatisfied. In my experience, it's not only "the public" who continue to work to have the issue changed even though it has been decided. I think we probably all are on a pretty equal basis on that.

I wanted to ask Mr. Slovic a question: When you were talking about public perception of risk you pointed out that the assessed validity of the evidence, depends on the prior belief of the person. Do you think that's entirely bad?

Mr. SLOVIC: Well, I think it will lead to opinions being very resistent to change. In what way do you see that?

Ms. SHARPLE: It depends, I think, on the basis of that belief, but I would like to think that among most intelligent people, belief is the result of their prior experience. I think one of the reasons the public is reluctant to move forward in any greater degree to a new technology, is that the public interested in this subject tends to be those people who have been involved in the clean air, the clean water fight, and the land use battles, and they are aware that policy is one thing and implementation is something entirely different. Now a public that has participated or observed the pollution control efforts in these air and water fields, I think, rightfully would expect very strong evidence that control of nuclear waste is going to work well before they would want to go into acceptance of it. If I'm right in saying that belief is not just a blind faith in something, but is a result of experience then I don't see what other basis you have to move forward on.

Mr. SLOVIC: I think it's very good about beliefs being based on prior information, so that when you get a new insight of information you have to kind of merge that with what has gone before. I think that's a logical way of proceeding.

I'm concerned, though, that the merger might not be made, that actually there will be considerably more resistance to change than is warranted given the validity of the new information. Nelcon has done a study of a case history of debates during a nuclear siting controversy in which she concluded that information on both sides of the controversy tended to reinforce the conflicting value position of the participants, and the groups used the debate mainly to legitimize their own position. This was the kind of thing that I was concerned about.

Mr. MOSS: Lois, your comment about the importance of enforcement is an appropriate one. It made me think that with reference, for

Now if the goal is to reduce uneasiness on the public's side, we may be inducing that uneasiness on the industry side. I think that the essential tradeoff has been made in California. So, in essence, I can present it here as one possible way to proceed, although I don't think the Federal government is in any position to do that.

Mr. MOSS: What you're saying is that the California Energy Commission, in the case of the state of California, can act as a surrogate for the public in making these evaluations, and that an attempt has been made to establish reasonable credibility whatever the decision is, and the hope is that the public will go along with it.

Mr. VARANINI: We may be on our way to the desert really.

Mr. ROSSIN: I just wanted to add something about the point of burden of proof. The kind of process that we are into here is quite a departure from practices of 10 or 20 years ago, as any of you who have been through it recognize.

The burden of proof on the technology is much heavier than it's ever been in any other society. The structural depth that must be met in order to go from here to there is arduous. They take time. They take effort. They require the development of a record, and it's a very serious obligation.

One of the things that I am continually confronted with is the question of what burden is placed on my adversaries when I go through this process. Is there any burden whatsoever on the person having heard the evidence, having weighed the evidence, having had it weighed by public bodies, and having a conclusion being reached, and a solid case having been made?

Is there any burden on the adversaries to accept that position, and take up a different issue, or are they perfectly free after this exercise is complete to go back to square one, raise the same point again, and completely ignore the evidence on the record that's been made?

That's a key point, because all too often I have lived through this where the same adversaries raise the same questions again after they've been decided in one form, a form requiring an extensive record, and one that in general seems to meet public acceptance.

Ms. SHARPE: I would say in regard to that, that I guess the burden of proof wasn't sufficient to convince at least that particular group of people. However, remember this morning someone pointed out that it was never going to be possible to get universal agreement on these subjects.

example, to the enforcement of the Clean Air Act, of the water legislation, when industry talks about environmental uncertainties what they seem to be talking about, at least as far as most environmentalists perceive, is whether or not the industry will be successful in changing the laws and making them more lenient. It's that kind of distrust of the motives and mode of operation and thrust of the other side that I think is difficult to deal with when you need credibility.

Ms. HOOS: No wonder I'm called anti-tech. There are three things that I want to mention. First of all, what you were just talking about, Larry. You and Lois have made a point that goes almost counter to something that we heard--that achievability should have been a basic criteria in goal setting--because immediately when you think of the requirements for clean air or whatever, if achievability had been a primary criteria then the compromises would have been made right away, quick and early.

What we have to do is to learn from Paul and other psychologists that we need to address very quickly the level of aspirations for the effort, and we find that if the level of aspirations is higher than when people try to move up to achieve it rather than to compromise it by setting it at some level of achievability, that is basically a compromise.

I would also mention that there has been almost a hidden agendum in the activities and thinking of the people who are interested in calculating the limits of acceptability, to find what is publicly acceptable in the business of risks and so on. There is something in this that merely says that once these limits have been ascertained in some way that these will be used as a goal from which to work backward. I would submit that this is really tantamount to shooting an arrow and then drawing the bull's eye around it, and saying, there is your target. It's a backing into something that really is counter to the kind of thinking that I think is somewhat more worthy here.

When we go to the third item, which is that of public participation, almost invariably it takes you the full circle back to experts and their credibility. What happens is such a polarization that your beliefs are sort of allocated, and you go the whole hog. If you go the technocratic way, then you learn that there is a kind of omission of self that some of us--the people who are totally technologically-oriented--sound off with a great deal of authority on all of the social issues.

They will stand up first of all and tell you that nuclear power is safe. All right, as technical people I assume that they know what they're talking about. Then they tell you about the need for nuclear power because of the economic situation, the international situation, so that they move rather quickly from being nuclear experts to economic

gurus, which is highly dubious because they draw their materials from the New York Times and Business Week just as anyone else would who is not an expert.

Then they quickly move into the political arena and tell you (1) about what is going to happen to this United States if we don't have this kind of energy, and (2) about the crazies and the cuckoos who are anti whatever it is that they are pro, so that they've done a political, economic and psychological analysis, and so there's a kind of omission that comes with this sort of business. You have to watch very closely.

I personally will listen very closely to someone who has the credentials in a particular field, and I try to learn. I think, however, that when we stray, as we all are inclined to do, that's the point at which we must stop and be challenged.

When we come to the matter of public participation, and when really down deep we have this hidden notion that we can then orient people, we can manipulate them to this point of view by flinging these experts at them. I think that's the point at which really the effort becomes self-defeating.

Mr. GUIMANIS: On public participation, it does worry me indeed. Let me give you some very recent statistics. I'm not speaking of risk analysis, a conception of risk. I'm speaking of public participation in local governmental processes.

In this particular case, dealing with urban planning and transportation, a recent national sample indicated that less than one-half of one per cent of the public --that is, individuals of voting ages-- have ever attended a public meeting. Two-tenths of one per cent of the total population of voting ages have believed that they could influence local officials or governmental officials in any decision making.

Obviously, the record is extremely poor, and from that point of view this is strictly a participation, never mind the understanding. From the point of view of Paul's proposal, ideas perhaps merit considerable consideration as to what can be done at least to involve public participation. Because as I said before, the audience here in this room is not public. I know one-third of these people here today, because I've seen them before. They are just not public.

Mr. MOSS: It doesn't sound to me that that sample was taken from the population of Sierra Club members. Do you want to comment, Brant?

Mr. CALKIN: Well, we've probably got a half of one per cent

of the population who are members, and we're not the only ones around. So there's probably a little more participation--letters and various other kinds of participation, but in a very subtle way that raises another issue.

I think Paul and Bill may be straining at gnats. Researching why people feel the way they do about the goals and risks they should assume and so on, may be a very fine tuning of a very crude machine.

Let me just give you one background example. About a year and a half ago, the public was asked to rate its confidence in eight institutions in the country. There were academic institutions, religious institutions and so on. The least confidence that the public had was in big business. The next was in big labor, and the next was in big government.

I submit you can look at how they want to weigh the risks and all that, but you've got two out of three that don't care.

Mr. MOSS: Is your message that we ought to think small? Lois.

Ms. SHARPE: Perhaps in making this sampling of the percentage of people who had been at public meetings, and the percentage of people who had thought they could influence people; these samples vary very much from place to place.

I have not doubted that this is absolutely true of most people who live in a central city, but you people who are in this audience know perfectly well that when you live in a suburb you know that you can go down there and influence your county board. I'm the product of a county, having lived there since it changed from farmland, that considers that the public has never left anybody in office whom they dislike long enough for them to be able to develop a built-in public machine.

There is a difference from place to place, but I would say that the public should have been drawn into a fish bowl, planning on these nuclear problems long ago, that early involvement of the public is the only protection against irrational fear. I would agree that the trust is not high with respect to elected and appointed officials unless the leaders that the public has chosen for themselves are in agreement with those public officials.

As the public was not drawn into fish bowl planning in this field, and since in a sense this is the basis of so much mistrust of the whole affair, I would say that ERDA had now a new opportunity thrust upon them as they go out to investigate sites, specific spots for repositories, and for recycling efforts in nuclear waste. They will

have to deal with the public, and the best way to go about this would be to try to do a low-key educational enterprise through organizations which these groups trust; people will have to have some knowledge before they can make rational decisions, and they won't take that knowledge if they feel it's a propaganda affair. But they do need to be involved or implementation will be impossible.

Mr. MOSS: Before I call on Gene, in about 15 minutes we will start fielding questions and comments from the audience. So you can start to write out your questions and hand them to people who will be moving up and down the aisles. Gene.

Mr. VARANINI: In Califronia, we run a human dragnet operation in terms of public involvement. We have an appointed official whose whole purpose in life is to go out with a net and bring in the public to involve them in our regulatory process in siting power plants.

In our first case, we have 26 interveners, 23 of whom are broke. Now the real problem I think is whether you want to go out and have some kind of paeon public participation or you want to have effective public participatcn. You might be able to qualify the public in groups, for profit and not-for-profit institutions, so that we don't get down to this sort of political goal line of saying who is it who really represents the public interest.

If you want to increase the input of the non-profit group, and that includes certain business groups as well as environmental and consumer groups, you have to pay for it. So if the public really wants to optimize public input it has to be willing to subsidize it, particularly when these processes, due to legal and other constraints, turn into a paralegal battleground--or a mine field, in terms of participating.

We have every combinatior that you can think of. We have unsworn testimony, sworn testimony, interveners, members of the public and every other category--which, I think, just tends to confuse the public even more. As a bottom line, I would say that you basically have to institutionalize a conduit to get the public in, or the non-profit groups in, and interested members of the public, and you have to subsidize their input in terms of the equity-resolving mechanisms that the laws are usually designed around.

Mr. ROSSIN: There are a number of constituencies that aren't very visible at a meeting like this, and one of the things that is foremost in my mind is a responsibility that I have as an employee of a utility: we have some constituencies that we have a contract to serve. It's an obligation, and we don't really have great choices in it. Many of those constituencies are not represented in this room today. Many of them don't know about this meeting, have never

participated in such a forum, and many people just plain don't have time.

It's something that strikes home to me because I spent a lot of time in the nuclear debate, but I don't have time to be involved in my own school board. I don't have time to be involved in some of the chores that my wife expects me to do around the house. Everybody I know is busy, and his hands are full with many other things, very few of them with the nuclear debate.

I think one of the things "public participation" is up against is finding people to represent constituencies that aren't liable to show up voluntarily, and finding out what's on their mind. I don't think it's an easy proposition, and I really don't have an explanation for it. All I know is that some of those constituencies are constituencies to which I have an obligation, and that's part of the reason I'm here.

Ms. SHARPE: Yes, I think you're right. You've got to be sure you have a good cross-section.

Mr. MOSS: Bill, a while back Dave Rossin asked you a specific question. Perhaps you could restate it and answer it.

Mr. BISHOP: Dave's question was, what about the ERDA approach? Does it measure up to the goals that our task group has laid out? Let me answer it first with my NRC hat on, and the answer to that will come to the licensing procedures, which ERDA will answer.

Mr. ROSSIN: That wasn't my question. It was in the task force deliberation.

Mr. BISHOP: All right, I was about to put on the other hat. I think that in some measures we have to say that it of course would, because we drew from the ERDA program. We asked the question of the ERDA program managers--why is the program taking these directions?--and incorporated a large part of their thinking into the goal structure that you saw.

There are some interests, however, that are outside the purview of ERDA, some of the issues with regard to institutional and organizational arrangements. For those of us in the Federal government, those organizational arrangements are imposed upon us by Congress in establishing our organization. In fact, the task group would have to look, I think, at the organizations and assess whether they do meet up. We didn't do that. We stepped outside those organizational boundaries.

Ms. SHARPE: Will ERDA, for example, have funding to carry any of this message to people through TV in a way that will not be a

sales talk for the ERDA program, but will really be an educational presentation? Really, you might reach many more people that way. Mostly, the agencies can only get on public television or on general television at midnight or 1:00 A.M.

Mr. BISHOP: The finger seems to be pointing to me as the Federal representative up here at the moment, but I'm not at ERDA, and I'm not familiar with the details of their budget. I can't answer it.

Ms. HOOS: I just want to add something. Bill made a point, in the little report that he circulated just before the meeting, and that is that not all voices are always heard in this business, and that it's terribly important when you're thinking in terms of not just achievable, but the long-range goals in their real-life context.

You need to examine the bureaucracy as part of the social environment in which you're dealing. One of the things that becomes extremely evident when you do that is to see that bureaucratic organizations have as their first law, that of self-preservation. So whenever there has been any evidence of conflicting evidence of anything, whenever there has been controversy about safety, for example, which we see from time to time, there has been a real tendency to justify the status quo, even in the face of what may be conflicting evidence. The response is always that the system is working in its own way to protect whatever this is. But, if you look closely, the system will work in its own way to protect itself. This is extremely important when there is such a reliance on technology as the protector. I would remind you then of the way a public address system can echo. I would remind you then of the safety or not-safety of pipeline welds. I would remind you of the Teton Dam. And, last of all, I would remind you of an airplane lost off an aircraft carrier--to suggest that the technical isn't the only consideration in any one time and place.

QUESTION AND ANSWER PERIOD

Mr. MOSS: Perhaps it would be good to begin to respond to some of the questions that have been asked. A number of them are on the subject of the issues raised by Paul Slovic dealing with public perceptions of risk. One of them asks, "How do we interpret the apparent difference between the past major public opinion polls on attitudes toward nuclear energy such as those reporting about 78 per cent to 22 per cent for building more nuclear power plants, and the

results you report from your recent work with the Eugene, Oregon, League of Women Voters sample?"

Mr. SLOVIC: I'm not sure when that poll was taken. It was referred to, but it could well be that over time as risks become discussed they become more salient. That may be one of the characteristics, one of the manifestations of the availability concept that I noted.

We all know that there has been much greater public discussion of environmental hazards recently than ever before. There's an increasing trend in this respect, an increasing sensitivity. It may be one characteristic of our response to allow probability-high consequence risk that the more we discuss it, the more we talk about it, the more concerned we get about it.

I don't think we have the fine tuning to be able to keep a quantitative degree of concern in mind. We may operate in sort of a threshold manner that whenever possible we may sweep these under the rug, and keep low probabilities to zero. We've got some evidence that this occurs a lot. For example, earthquake risks. Many people can sweep it out of their minds because there's only so many things you can worry about at any one time. As we discuss these hazards it may be that suddenly we cross the threshold, and then see them as something yet that we have to be concerned about, and therefore our opinion may change drastically about it.

Mr. MOSS: Of course, your sample was not of the same population as the other study. Also your sample did show a fair degree of support for nuclear power, at least a refusal to say that it should be discontinued.

Mr. SLOVIC: The Battelle sample.

Mr. MOSS: The Battelle sample, right. Another question: "Your presentation assumed that the public is making a decision on nuclear power or waste management. Hasn't a great many of the local public already made a decision that economic growth is undesirable, and a social change is necessary, and that by stopping nuclear power the mechanism will be developed to bring about this change? Is nuclear power or waste management really the issue? Is risk discussion even necessary?"

Some people, no doubt, think that one of the ways of accomplishing the restructuring of society towards a situation that they find more amenable to their taste is through limitation of energy growth. Any comment?

Mr. VARANINI: During the initiative process in California,

that kind of comment seemed to crop up in the Eastern trade papers as if it were some kind of discovered fact or some kind of a collusive or conspiratorial operation by the upper middle class or a certain group of upper middle class in California. I'd just like to point out that some people who are opposed to nuclear power share a certain set of common principles, among which are some concern about high-resource, through-put growth, viz-a-viz other forms of growth and quality of life. For example, one might be able to help influence whether his area looks like Palo Alto or the Iron Triangle, in terms of outcome.

The second thing is that all society is sort of motivated by groups of people--the war in Viecnam being an interesting example of so-called upper middle class elites being thrown in the can, and fasting and so forth and so on, and then the movement beginning to pick up steam as its effects were better known. I'm not saying there's any relationship between those two things. All I'm saying is that I think the fact of life, the basic movements, start with small members of people who share a common goal.

I don't see that as being conspiratorial. I see that as a fact of life--just as a small group of people with common goals got "atoms for peace" off the ground and passed the U.S. Atomic Energy Act. It's the same kind of thing. I don't see it as some conspiratorial thing or something that ought to be shied away from, or demonstrated as one kind of principle surrogating for another. I think that they tend to be corollary to one another, and I don't think that it's particularly shocking in every sense.

Mr. CALKIN: One of the things that concerns me is that when you try to sample, which you already have, as an attempt to influence perceived disadvantages, it's going to be something like this--"or we turn off the iron lung"--to take it to an unpleasan. extreme. It's very difficult to get the sample free. People on the anti-nuclear side paint an equally ludicrous picture, but when you have an attempt to influence the perceived disadvantages you're only sampling either-or on one side of the fence. There is no alternative in your sample. There's no other technology against which people can balance a perceived advantage. So when you try to figure out how they want to assign the risk, it's a choice between one bullet in the head or two. It's not a fair deck to start with.

Mr. MOSS: We have a few questions relating to the degree to which this meeting is the kind of public participation that is sought after. For example, one question asks if we feel this kind of meeting is "truly public participation, or is it really a small collection of special interest groups? Does the general public even care, let alone understand?"

In fairness to the sponsors of the meeting, I want to say that they didn't attempt to have the panelists or the audience be a representative cross-section of the public. Quite a number of notices of the meeting were sent out--I think about 15,000--so they couldn't be terribly selective in whom they invited. No reflection on the panelists or the authors or the audience...But no one presumed that this would be a truly representative sample of the population. Would any of the panelists like to comment on this?

Ms. SHARPE: I've heard this question asked by many people and many different types of people. The question is usually put: "But how do you define 'the public'? How can you be sure that you have gotten a hold of the public, or reached the public?"

Well, of course, you can't be sure of that. We're all multiple men; we are one kind of public in one set of our lives, and we're another kind of public in something else that we do. We may be active citizens on one set of the nuclear waste issue, but even people who are not environmentalists in any other sense often are hunters or fishermen. There's this kind of broad spectrum that many of us cover, a kind of continuum that we don't always perceive.

I think the first thing that is known about public participation is exactly what Mr. Calkin said, that public involvement is begun by people who are influence makers, who can move and shape. If you want something done and you're in an area, you try to reach that part of the public, and they in turn reach other people. You just can't go out and get a cross-section of the public that will be interested in the same thing and herd them into the room. We do not in our society have that kind of compulsion. The public comes voluntarily if they're interested, and that's all you can deal with.

Mr. MOSS: This question for Paul Slovic asks if X-ray benefits are accepted by the public. "Is the public fully advised of possible risks before consenting to X-rays? Are procedures followed which would tend to bring before the party being subjected to the X-rays knowledge of the risks?" I think that part of it must be a rhetorical question, because the answer is obviously no. Would you like to comment on that?

Mr. SLOVIC: Yes. It seems to me that X-ray is a very widely accepted and used technology. I don't believe that the public is fully aware of the hazards involved. In fact, there was recently developed quite a controversy over the use of mammograms for screening where it's of some help to physicians. They have come out and said that this is too risky to use as a wide screening device. It should only be used for high-risk individuals. This will be unsettling to many people who will not quite know how to react to the fact they do face the risk either way. I think it's probably obvious that we

don't have enough discussion of the hazards that involved in X-rays, although certainly we're a lot more aware than we were many years ago when the technology was first put forth.

Mr. MOSS: Here are a couple of questions that I think cast doubt at least in the minds of the questioners as to whether it's a good idea to raise such issues:

"Does the public have the right to know? Aren't there people who don't want to know about the risks of nuclear power? When the public becomes informed, we dictate that this information be given in benefit/risks--in other words, death terminology--which creates undue and perhaps unnecessarily high concern? Do we have the responsibility not to cause worry to some extent among the non-informed public?"

In a similar vein, "Who are the credible sources of information who should be used to educate the public? You have stated that the public is unable to cope with costs for risk-benefit analyses. On what basis does one predicate positive benefits of further development of nuclear power?" That one was addressed to Lois because of the comment she made. Any comments on the public's right to know and avoiding worry on the part of the public?

Ms. SHARPE: I can hardly believe that's a serious question, because only under a totalitarian system can I visualize wanting to keep facts from the public. You're not going to go around just forcing facts down people's throats, but to say that you want to keep people in ignorance for something which may affect them...I can't believe you're serious about that kind of statement. Now, if it causes people worry--I think that Mr. Slovic is the one to answer that. I would feel that people have a certain sloughing off quality. They don't worry about everything that comes along. Don't you think that we're selective worriers?

Mr. BISHOP: I'd like to make a response from a slightly different viewpoint, that of a government employee who is charged with obeying some of the laws, and make it quite clear that our legal representatives in Washington have told me that the public in fact does have a right to know. They've told me by the Freedom of Information Act. They've told me by NEPA, and in fact it's told to us in the Constitution of the United States in the First Amendment. So I think the answer as far as the government officials are concerned is, yes, the public has a right to know anything it cares to know.

Mr. ROSSIN: Can I ask a specific on this to my two fellow panelists? Mrs. Sharpe mentioned a possibility of ERDA preparing information for the public, and I would like Mr. Varanini to respond to that, considering the experience in California over the past few months.

Mr. VARANINI: I don't understand the question.

Mr. ROSSIN: One of the issues that got a lot of ink in California was the question of an ERDA publication and its impact on the initiative campaign. What would your reaction be to the kind of proposal that Mrs. Sharpe mentioned a moment ago? Why doesn't ERDA prepare information on the subject?

Mr. VARANINI: The information that I have on that particular ERDA document is that it tended to characterize technology rather than merely to report on it. I think it's sort of inherent. I don't know how you filter that out, or who has the right to filter that out, or if in filtering it out you're making a counter-value judgment.

I don't think that that particular document will enhance the future role of ERDA's publications in terms of affecting the unbelieving public. All I can say is that I hope they do better. I'm sure the watchdogs that we have within society will blow the whistle if they think they've gone too far in either way.

I just want to make one other point, before I get too pontifical. There are two other commissioners here from California watching me today, and during the mixing periods I think you can either validate or unvalidate any of the comments I've made, and they have significant points of view on many of the matters that are being covered here.

Mr. MOSS: Jay Silberg asks the question of Ida Hoos. You talked about the "omniscience" of those favoring nuclear power. You ignored the "omniscience" of those opposing nuclear power. For example, Barry Commoner's expertise of his ability to predict how people will react to the conservation effort. At least the technical people favoring nuclear power have the technical expertise. Would you like to comment?

Ms. HOOS: I'm sorry that you got the impression that I limited the submissions of any sector of any technical population. I tried to point it out, and maybe I better recast it in a somewhat different framework. That information and the whole body of information is an extremely difficult kind of reservoir. There is, as Paul pointed out, the kind of collective process that goes through the information before it becomes part of our general stock in trade.

There is always the business of ERDA trying to supply information; there is a fine line between information and propaganda, and this we saw very well in some of the publications. I think we have to remember something that Pirandello put very nicely into the mouths of one of his characters, when he had him say, "a fact is like a sack--it doesn't stand up until you put something in it." So it really depends on who put it where and why.

Mr. MOSS: We have about a half dozen related questions for Bill Bishop dealing with the work of the task force. I think they're exemplified by this question: "Will your task force eventually address the issues of the possible ways goals/criteria can be implemented? Spelling out general goals is useful only if realistic implementation scenarios are also developed."

Mr. BISHOP: The answer is quite simple, and that is, no. The task force was tasked with the laying out of guiding principles. The next step done by the NRC staff is both a review of those guiding principles and--once those are established as some sort of policy--then laying out the performance criteria by which ERDA and the industry must live, and placing those into the body of regulations through our regulatory process which involves, of course, some legislative, public participation. Those then will be, if you will, the battle plan for ERDA and the industry; and not in fact the guiding principles as articulated by the task force.

Mr. MOSS: Here's a question that deals with the implementation plan arrived at before the establishment of goals: "Granted that for any action there ought to be plan, and for any planning there ought to be a goal, but assuming that we will not be able to develop soon an acceptable goal, what will happen to action on pending matters relating to the NRC and the nuclear industry?"

Mr. BISHOP: There are, of course, a number of pending actions. Our friends in the critical community, our friends in the industry, have pointed out to us a great lack of criteria, a great lack of action on the part of a number of Federal agencies. In part, I think, in the last couple of years, that's been remedied through legislative action in applying resources to the Federal agencies for furthering that action. In fact, those pending actions are going on absent the goals, because those goals are embodied in large measure in existing regulations, existing programs at the agencies, and the program plans for those agencies over the next few years.

Mr. ROSSIN: I think the effort on the part of NRC to come up with a set of specific goals, while necessary in order to get from here to there, really at the same time--I think there's a common-sense goal which is the overriding one, and that is a safe and environmentally acceptable system that the country is able to afford, and will commit itself to do. Everybody realizes that this is the basic objective; granted a structure of more detailed goals, going along with this is a reasonable thing to develop.

Ms. SHARPE: I think it would go farther than that. I think it's not easy sometimes in that list of goals to distinguish what I would call goals from criteria. But the Federal government has a regular system--goals, criteria, standards, regulations--and each

part of it has to be planned and arranged and created and organized.

Mr. CALKIN: Larry, excuse me a second. There's a little pussy footing going on here. What happens is everything goes ahead.

Mr. MOSS: Here's a question asked of Paul Slovic: "On the basis of your research and analysis of the literature, do you feel that it's possible to define within a reasonably narrow range a level of risk which is acceptable in the development and use of energy provision systems which involve either conventional or novel technologies? If so, how might we go about this?"

Mr. SLOVIC: No, I don't think we're able to define it that carefully. I think that the level of acceptable risk will be continually changing. I think this is one of the implications of the analysis that Starr has brought up that shows that acceptable risk will be a function of perceived benefit so that what is acceptable or what is unacceptable today may well differ tomorrow when we suddenly have a different perspective on what the benefits from certain energy systems are. So I think it will be a very dynamic kind of thing.

Nevertheless, at any given point, all I can suggest is that we can interrogate representative samples about their values. One can do this to any degree of specificity. You can bring people together. You can give them the job of discussing these issues in order to communicate to you what their values are, what is acceptable, what isn't. I think we can learn a lot from systematic observations of groups, and sample any way that one wants and to bring a broad representative set of viewpoints to bear on this.

Mr. MOSS: R. F. Williams of Electric Power Research Institute asks the question which is clearly related to the last one. He says, "Regarding the low probability, high consequence event and the tendency of the public to become more concerned as the event is researched and documented in safety analysis or elsewhere, has any research been done on the impact of the Rasmussen report on reducing the public perception of risk--for example, the introduction of electric power in the late 19th and early 20th centuries?"

Mr. SLOVIC: I'm not aware of any research on the impact of the Rasmussen report. Regarding the second question, yes, I think that information can reduce risk if it comes from a credible or trusted source.

Mr. MOSS: Mr. Williams also says the issue of credibility of facts in the record and sufficiency of response was posed by several panelists but never fully answered. What is the appropriate level of credible response? How much should be spent attempting to convince some who may be unconvincible, and what is the responsibility

of those who disagree and cause delay to the social impacts, and the real economic and social consequences of their delay?" He adds that "perhaps responsible critics should be asked to state in advance what tests or proofs will satisfy as one test of their responsibility." Comment? Brant.

Mr. CALKIN: I think all decisions are organic. They can be changed, and people will try to change them. The most permanent decisions tend to be those in the judicial branch, and even those aren't final until people go back to try to either amend the law or the Constitution. I can tell you as a participant that my adversaries refight every statute at the hearing, or they refight the regulation, and so do we, because in the long run that decision is not final, and it either has to be propped up or overturned depending on what side you're on.

You never make the case so final that you could walk away from it, I don't care whose side you're on. It is never final--and that is the way the government works. I used to resent that, but now I consider it an organic process, and I'm going to spend a little more time on it.

Ms. SHARPLE: I think that's absolutely true; this is not a one-sided thing. People who are in the industrial side feel that the environmentalists are never really accepting a decision. They just keep on working away. People who are on the environmental side have exactly the same feeling.

That was one of the reasons for my question about implementation. When a decision has been made which is favorable to the environment, the corporations which have to do that thing--put in that safety device or put in that treatment if it's air pollution and so on--corporations feel that this is additional cost, that there's no profit. They don't resist it actively, they drag their feet; and the Federal government and the states never have the staff or the funding to enforce these regulations. So you see it works that way on both sides.

I would go one step farther, Mr. Calkin. I would say that even in judicial decisions these things are changed. I have long felt that the courts, including the Supreme Court, respond to the pulse of the people. They respond to the fashion in thought, too. You remember there was one time that they simply couldn't pass the Child Labor Amendment--and yet ultimately the public opinion had reached the point where that was the only acceptable way to go.

Mr. MOSS: "What is the relationship between perception of risk and behavior? What does it mean that people do or do not perceive something as having high risk? Do you have any theoretical linkages between how people perceive risk, and how or in what direction they will take action to change public policy, etc." I guess

the "etc." would include their own individual choices.

Mr. SLOVIC: That's a very complex question. It really asks about how thorough our understanding of the relationship between risk assessment, risk perception and behavior is.

First of all, the question is involved in what do we mean by "risk," and it means different things to different people. Risk involves both probability of consequences and magnitude of consequences. There is some evidence that how people perceive probability of hazard will relate to their behavior. For example, we got some evidence that if you believe that the probability of some hazard is lower than a certain threshold, then you sweep it out of your mind. You don't want to be concerned about it. You won't take protective action. For example, this seems to be involved in determining whether people will buy flood or earthquake insurance.

There seems to be some evidence that after the movie "Jaws" there was quite a fear of sharks; people were changing their behavior with regard to their swimming habits and that sort of thing. I don't feel that we really can precisely document exactly how perception relates to behavior in this way, but it seems quite obvious that there is a certain linkage here.

Mr. MOSS: We have a couple of questions here asked of Gene Varanini probing some of the things he raised as part of his discussion of what's happening in California. "Concerning the high-touted California scheme, have the governor or the legislature or pertinent commissions identified in clear terms the criteria that they will apply, in the name of the public, to determine that the particular nuclear operation is safe? Isn't it correct that the decisions that are going to be made by the state government will be no more certain or sound than the same decisions made by Federal agencies, for example, EPA or the NRC, or a group of informed citizens?"

Mr. VARANINI: The answer is no. It seems to me that basically what we have is the shared responsibility.

I think that our process is one that basically starts in a fairly organic manner to sort of push the energy efficiency ahead of supply stimulation. So we try to look to that first, and the utilities are asking us to look at it not only in demand target sense but in the sense of optimized supply plans. They're beginning to say to us, we want to substitute nuclear for oil because it's cheaper, and we want you to validate it on that basis, not because it's needed in the sense of some alternate supply target.

We try to take a look at the need first, and whether there are pure alternatives to supply stimulation--such as conservation or

advance conservation concepts. Once we've looked at that, then we go to supply stimulation and look at the technology and the acceptability of the technology. And only then do we go to site suitability and externality regulation.

I think it basically is a design of a receptor where the state governments are having to manage the externalities, the state governments are caught holding the dislocation problems. The Federal approach has basically been to promote and to develop, moving from east to west in this country. I don't think that those thrusts have been particularly aligned, although they have been obviated somewhat by additional agencies.

Basically, the agencies are after one another. I don't think you see a unified energy policy, or unified energy approach. Now whether California can pull this off may be a fairly noble experiment. It may be impossible for humans to do that, and for government in particular. We'll see.

Mr. MOSS: The second question for you, Gene, asks about what you said concerning avoiding large projects because these could be held up by environmental or other protests.

"Isn't this a complete cop out? Shouldn't we design our political and administrative systems so that public input can be had without allowing for paralysis of the decision-making process, rather than accepting that paralysis as necessary consequence of public participation?"

Mr. VARANINI: To balance that out I said also that large-scale disasters any place in the world would also bring the system to a crunching halt. For example, if we lost a reactor or a reprocessing plant in Pakistan, we might not just assign that to sort of hereditary technological capability. We might assign it some risk in terms of the technology itself. So basically what we were trying to point out was that the reaction itself is a signal of acceptability or unacceptability. We felt that one of the things we wanted to look at was whether there were alternatives that people could agree on that were in fact alternatives and were much more acceptable.

One of the things we were looking at is smaller-scale nuclear, for example, nuclear that stays on line more. Another thing we were looking at was clean fuels in terms of methanol, LPG, naptha fraction, in terms of alternatives to very high-cost LNG, and to use those in periodic episodes of air pollution impact in LA to be able to use our oil plants rather than using base-line oil as peakers. Whoever was worried about that is certainly welcome to a copy of this document. It's basically a think piece which tries to set forth some of those options.

Mr. MOSS: Mary Sinclair of the Sierra Club asks a related question of Dave Rossin. "Why is the term 'delay' always applied to the decision making process at the point at which public participation begins, or citizens want to exercise their rights?"

Mr. ROSSIN: I didn't know that it was.

Mr. MOSS: I suppose the implication of the question is that when people in the industry talk about delay of the decision-making process they're usually talking about the period of public review, discussion, debate, regulatory action and so on.

Mr. ROSSIN: Okay, you've explained a different question. Once again, anybody who has gone through this process recognizes that it takes time. It takes long periods of time, and the time for the public participation part of the process is only a fraction of it. This is a complicated, long process, and what the industry has learned is that they've begun to recognize the length of time that might be involved and, of necessity, have factored it into their planning, because the consequences of poor planning are very serious. As one begins to understand what's going to be involved and what one is going to face, one adjusts plans accordingly. That's just basic common sense.

What I was talking about was not delay for the sake of carrying out the public planning process. What I was talking about was recognizing that these processes take time, trying to figure out how much time they take, and simply including that in the weighing and balancing when you look at all the other factors.

Ms. SHARPE: Is there anyone here from Northern States Power? Well, I think that they should seek you out and discuss with you Northern States Power's planning processes with the public.

My immediate response, although I may have done you an injustice when I immediately rose up, was that there really should not be "somewhere down the line later on" when you get into a hassle with the public. That's why I speak of Northern States Power because they have been carrying on what is really fish-bowl planning from the very moment that the thought of the plant was in their minds. People were brought along all the way, and there never was this "final time" that had to be allotted.

Mr. MOSS: We have a number of questions dealing with low-level waste. The first one for Paul Slovic: "Does the public have the same perceived risks of nuclear waste, whether it be high-level or low-level?"

Mr. SLOVIC: I don't know all of the work that's been done on

the perception of nuclear waste. I am really only familiar with the Battelle study. Maybe that's really the only study been done, and maybe not, but I don't recall that that study dealt with this question. I think I'd like to just re-emphasize the point I made earlier in my talk that almost ridiculously little effort has gone into looking at questions such as this.

Mr. ROSSIN: I agree that there has been a very limited amount of social science work on these studies, but there is an implication from Paul's remarks that this is really quite a serious matter in the nuclear power debate. Yet, I've been scraping my brain to try and think of any examples that other industries or other fields or other threats--the food industry, aviation, air pollution--where as much thought has been given as the rudimentary stuff which is going on in relation to the nuclear controversy. It seems to me it's a new field, and almost an experiment as such.

Ms. SHARPE: Think of the chemical industry and the turbulence they've had.

Mr. ROSSIN: But my point is the kind of studies that Paul is talking about haven't been done in any of these others, anywhere else in our society, to the best of my knowledge.

Mr. MOSS: Continuing on the question of low-level nuclear waste, two questions for Bill Bishop. The first: "Has the task force adequately assessed current research on low-level radiation and its potential long-term chronic public health effect?"

And the second: "Two of the six commercial low-level nuclear waste disposal sites have been studied and in both cases movement of buried radionuclides has been demonstrated. The goals discussed here seem in no way to address this present real-world problem of low-level nuclear waste. What are the goals pertaining to low-level nuclear waste management? Have we met these goals? If not, what are we going to do about it? Can we hope to succeed in defining goals of high-level management if we have a failure such as those seen at the low-level sites staring at us?"

Mr. BISHOP: Wow, that's not a question...that's a call for a lecture!

Let me take the first question first, with regard to low-level radiation and the effects which are presently controversial. As to the adequacy of the task force's consideration of those questions, we looked into that briefly. I would not say that that would be the sort of adequate review that one would require in order to set limits, and concern ourselves in fact with those controversial parts of the questions of effective radiation.

We felt that any further review would not give any further concern that we would have to address in our goals on a generic sense. That is, we had already stated the protection against radiation effects was something of a part of the goal structure.

Now on to the question about commercial low level waste disposal sites. Yes, there have been two recent instances of failure or inadequate performance of two of the burial sites. The one case is easy to analyze. That was the Beatty, Nevada case in which some material was illicitly removed from the site. That was done by the employees at the site. It was discovered by an inspection, and it was corrected. Most of the material was capable of being tracked. It was, in fact, a failure of the management system there.

So, yes, that's something we have to take into consideration. It's been reviewed. We found no instance of harm to those people involved, but it's something that is simply not to be allowed in the operation of those sites.

The other site is the Maxey Flat site in Kentucky where radionuclides were found off-site. The mechanism for their travel to that location is not unequivocally defined. It seems that a majority of it may have been above surface, rather than through the geologic media, through failures of the equipment involved and the handling of the waste at the site. Both of these instances are, therefore, cases that can be corrected by operational changes at the site.

Now, let's see as to the goals pertaining to low-level waste management. I have to say that those have not been fully laid out. There is a task force underway at the commission, mandated by several legislative committees, looking into the state and federal roles in the regulation of those sites. A large part of the consideration by that task force has, in fact, been: What are the intentions for disposal of low-level wastes, not just in shallow, land burial but ultimately all the possibilities that exist?

So have we laid them out? I think not. Have we met them? Not in all cases. What are we going to do about it? Wait a couple of weeks or months and we'll have that plan on the street, and we hope to succeed in defining the goals of high-level waste--if we have that real-world problem still existing. I see no reason to think not.

Mr Moss: Here's a question which, as phrased, is not really right on target with regard to the subject of this discussion, but I think it can be rephrased to stimulate some important discussion. It has to do with the economics of handling the back end of the fuel cycle for waste disposal, and whether or not in setting appropriate goals for the back end we might price nuclear power out of the competition. The question is asked by Bruce Green and Mary Wade:

"When the expense of adequate waste management or the expense of dealing with the consequences of inadequate waste management is added to the cost of developing, building and maintaining nuclear power plants currently or within 10 years, is nuclear power an economically feasible endeavor?"

We haven't really spent much time talking about the way in which nuclear waste management goals might affect nuclear economics, and I will appreciate any comments on that point.

Mr. ROSSIN: Utilities are corporations, and economics play a key role in their decision making. Those companies that have chosen nuclear power have had to include in their thinking some contingency allowances for what other costs may come to bear on the technology. They make the most realistic and the best estimates they know how to make, and they may be wrong because there are a lot of uncertainties. I think it's in their best interest to make conservative and careful estimates, because obviously they're the ones that are going to feel the pinch first if their estimates have been far off base.

My knowledge of my own company's thinking, and that of a number of other utilities, says that they have made conservative allowances for possible costs at the back end of the fuel cycle, and their decisions are visible in the selection of nuclear as an option. I don't think they'd make those decisions unless the economics supported it.

I don't want to get into the overall debate, but just one point about utility decision making: A utility does make economic decisions between what it considers to be viable and environmentally acceptable alternatives. You put those alternatives up in front of you, and then you look at the economics between them, and this and many other considerations dictate some final decisions. I think the answer at this point is that those who have selected--and are continuing to select--nuclear power feel that the economics are there.

Mr. MOSS: Brant, did you want to comment?

Mr. CALKIN: Yes, Larry...the failure to address an immediate economic term--the cost not only of establishing what the tail end of the cycle is going to be, but continuing to utilize it, whatever it comes out to be, if it does--is a perfect example of an externalized cost which is borne by the public at large instead of the user.

It's throughout the cycle. We have it very clearly in the waste end as I've just described, and we have it in reprocessing, in the Nuclear Fuel Assurances Act. It's in the mining, because we're not handling the mining wastes. I happened to come through Mexico, and we have a lot of it there, and I can tell you it's stacking up on the

ground, and we're not addressing the occupational health and safety problems of miners.

Every one of those is a subsidy. It permits the product to be sold without fully accounting in its price what its true costs are, and one of the reasons we're in the energy policy mess we're in now or lack of energy policy mess--is we've never allowed the true cost to be included in the price of the product.

We went 50 years mining Appalachia without putting the price of repairs in the electricity bill, and we're doing the same thing in the nuclear fuel cycle. It's going to complicate our lives enormously, and it's mortgaging the future at the same time.

Mr. ROSSIN: Look, I don't think there's anybody in the utility business who wouldn't prefer to see costs accounted for properly. The internalization of costs is something that's coming. It's a difficult matter. Obviously, if it were simple and very clear it would have been done long ago, because it's to everybody's advantage, the utility, the consumer, the regulator, and everybody else.

It's an evolving thing and it isn't here yet. All I'm saying is that this is not a situation that's unique to nuclear power. It's not unique to the power industry. There are externalities all over our accounting system, and in time I think we'll begin to internalize these and account for them more effectively.

Mr. VARANINI: We've made some runs in California on supply models, and basically we found that utilities are cost minimizers to the extent that they see costs. The real problem now is the quantification of social costs and marginal social costs in these projects. I do think in all fairness to them that when we try to validate and mimic their planning process, they in fact did minimize costs as they see them.

Mr. MOSS: Well, that's a good reason for internalizing external costs; because, in minimizing their combination of private economic costs and now internalized social costs, they will work toward achievement of public goals.

Mr. VARANINI: Yes, the only problem is that the public service commissions are committed sort of to a continuing process in that they load them in the front with not a fully-quantified cost, and really the public service commissions have some obligation to continue and pick up that back-end cost as it's identified. So you may go through one whole generation where your planning is off by some factor. But I think assessing blame is irrelevant. It's really a quantification problem and an institutional problem.

Mr. CALKIN: I don't think it's quite that easy. When you have an active seeking of legislation to pass on the costs, as in the Nuclear Fuel Assurance Act, that's not picking up things you haven't figured out how to assess values for. I understand and appreciate the enormous crap shoot that you show these are in, when it comes to figuring out what some of these true costs are and having them properly assessed, but it has not been a benign process.

Mr. MOSS: Another example of that is the recent proposal of the Federal government to take over operations of the Barnwell plant and to invest money in both waste management and fuel fabrication. A question for Gene Varanini from Joe Furnage of Yankee Atomic Electric Company:

"Has the assessment process which you are involved in California itself been validated? If I understand your position as one which advocates no movement until the validation process occurs, then I am persuaded by your argument to suggest that you halt all assessment until the impact of the commission's work is assessed."

Mr. VARANINI: Fine, thank you very much.

Mr. MOSS: The open-ended nature of this progression is of course counterproductive to doing anything. Any comments on whether or how the impact of the assessment process should be analyzed?

Mr. VARANINI: Continuously.

Mr. MOSS: Let me close with a couple of questions that deal again with the nature of public participation:

"Public participation seems to have been defined as a number of elitist groups in competition to establish the supremacy of their effective beliefs, ideas or outright prejudices. If so, is the term 'public participation' not an improper term to use?"

"Is public participation to the Federal agencies the 'public' (man-off-the-street) or is it the person or organization member who shows up at a hearing, or is it that 'public' who you are sure agrees with the Federal position, but doesn't show up at your hearing? Who are you trying to reach?"

This must be a question for a Federal employee. Anyone can answer those questions.

Mr. CALKIN: I'm not sure I can answer the question; I think it was to a large extent a statement. But, let me suggest to you that there may be a different way to do things, and I'm seeking private funding to try this. I'd like to establish at least for a select

agency or perhaps a state government a shadow government which would operate in the evening, when the citizens are available, which would take testimony from bureaucrats.

Mr. MOSS: But you must admit that not every citizen would show up for the meetings. You still have the problem of a selected group.

Mr. CAFFIN: I wonder how many of the agency people would.

Ms. SHARPE: I think that it's copping out somewhat to immediately conclude that the people who take part in what we call public participation are in some sense an elitist group. Do you mean they are elitist because they are better educated, because they are richer? Or do you mean that they are elitist because they have a passion on this subject?

I was engaged in an interesting do at one time--at the height of the period when we were talking about participatory democracy. We haven't talked about participatory democracy in the last year or so, but during the civil right days and when the social crisis of the cities was so high, we heard a lot about participatory democracy. All you people who were planners were having something--whose special term I can't think of now--where the actual planning for areas was involving the people who lived there. Now all those things are going on, and if you think that this is the kind of public participation carried out by Sierra Club people riding down the Grand Canyon because they can afford to go on that trip, you're mistaken. It includes all kinds of people--poor people, rich people, people of all races, people of all backgrounds--but the basic requirement is that they should be interested.

The organization from which I come, and in which I've spent a good many years working, makes a definite effort in its public meetings to run many of them by invitation only, not because we want to be exclusive but because we want to invite a cross section of the public so that people of different attitudes and experience and prejudices and biases--because we all come with those--are put together. They can educate each other. It's not necessary for us to carry this out. It's a tremendous spectrum of people involved in this sort of thing.

Mr. BISHOP: I feel somewhat required to respond on the part of the Federal agencies to whom we view as the public.

Public participation is often bandied about in our conversations in the Federal government--and also in public conversations to which we're privy--and it often sounds like a new populism.

When you come right down to it, this nation is a democracy; and, in a democracy, we in the Federal government are required to listen to all legitimate concerns, because we are the public servants. That sounds like a bland thing to say, but it's true. What we hear are the spokesmen. So, when you ask what does it mean to the Federal agencies who are public, I think it really means the spokesmen of the many constituencies that we serve.

Mr. MOSS: This discussion will be resumed tomorrow morning with the presentation of two additional papers, and, with one exception, the same panelists commenting and responding.

Session was adjourned.

SESSION III: GOALS AND CRITERIA (Continued)

MODERATOR: LAURENCE I. MOSS, ENERGY/ENVIRONMENT CONSULTANT

Presentation of papers by:

MARK SHAREFKIN, Resources for the Future, Inc.

GENE ROCHLIN, Institute for Government Studies, University of California, Berkeley

Panel discussion with:

WALTON RODGER, Nuclear Safety Associates

LOIS SHARPE, Former Staff Coordinator, Environmental Department, League of Women Voters Education Fund

EMILIO E. VARANINI III, Commissioner, Energy Resources Conservation and Development Commission, California

IDA HOOS, Space Science Laboratory, University of California, Berkeley

IVARS GUTMANIS, National Planning Association

WILLIAM BISHOP, Nuclear Regulatory Commission

Mr. MOSS: I would like to welcome Walton Rodger to the panel. He will be substituting for Dave Rossin. Walton is a chemical engineer with 34 years experience in reprocessing and waste disposal, mostly at the Chicago Metallurgical Lab, Oak Ridge National Laboratory. For 12 years he was General Manager of the West Valley Nuclear Fuel Services Plant during its construction. He is now a partner in Nuclear Safety Associates.

The first paper will be given by Mark Sharefkin, who is a senior research associate at Resources for the Future. Mark has a Ph.D. in economics and a Master's in economics. He is a specialist in mathematic economics and econometrics, presently working on two areas: the first, conceptual problems in evaluation of environmental risks, such as from toxic chemicals, nuclear power and DNA and nuclear power policy;

and secondly, applications of differential topology to equilibrium theory. I hope he talks about the first one today.

"Choosing Among Waste Management Alternatives: Relevant Criteria and Their Implications"

MARK SHAREFKIN, Resources for the Future, Inc.

Mr. SHAREFKIN: This is a session on goals and criteria for waste management. I will begin by stating two somewhat broad goals, and then I will turn to a discussion of those goals. The two broad goals were implicit in much of the discussion yesterday. Call the first economic efficiency or cost effectiveness. Whatever we want to do we want to do in the least costly way possible, consistent with other objectives.

The second broad goal we might call intratemporal and intertemporal fairness or equity; here we mean that we believe it unfair to impose unreasonable burdens upon future generations.

Now these are very, very broadly articulated goals and as always there are problems of specification and interpretation. I would subsume, for instance, environmental objectives within the second, or equity, objective because environmental questions most frequently are essentially distribution questions. The goals of intertemporal fairness is easy to state but hard to pin down. Fairness to the future is a little like fairness to your children; what is fair depends upon what you assume about their innocence or malevolence.

A second comment, which I ask you to remember through the rest of the talk, is that these two objectives, like others--even some others embodied in legislation--are conflicting or competing goals--full employment and price stability--it is possible that we can't have more of one without less of the other.

This raises two questions. First, how much do we really know about this trade-off in nuclear waste management goals? Do we understand it any better than we understand the unemployment-inflation trade-off? And what can we do, if anything, to understand it better?

The second question is the following one. Suppose we had full knowledge--not necessarily certain knowledge, but at least complete

knowledge in a probabilistic sense of the possible trade-offs between those two goals; how would we choose among them? Even if we had a very precise understanding of how much you had to give up in price stability to maintain a certain unemployment rate, for example, the choice of that combination would be a decision laden with distributional and other problems. Similarly, in the waste management trade off case, even if we had a very precise understanding of what we had to give up in terms of one goal for another, the choice would be difficult.

Now, regarding the question of what the trade-offs actually are; like many of you, I have drawn what knowledge I have from ERDA 7643, the document that was referred to yesterday as TAD. I think there is a good deal of information in that document relating to this question of the trade-off between competing goals. And if you think we have troubles in the price stability-unemployment case, we have, in some respects, much more delicate problems in these exotic hazard cases. Whether it is nuclear waste management and transuranic migration in the biosphere, or the DNA experiments, our understanding of the consequences of specific actions is very limited.

But suppose, for this morning's purposes that we had a pretty complete, if not certain, understanding of the trade-off between efficiency and equity objectives. This would only force us to face up to the problem of choosing a sensible combination: that choice is the subject of my conference.

I warn you that that paper bears the hallmark of the conceit that thinking about these questions matters, and the conceit that trying to sort out the criteria--often invoked implicitly in making these choices matters. John Maynard Keynes very beautifully expressed this conceit when he said that ideas, and little else, run the world; and that madmen in authority were distilling their frenzy from some academic scribbler of years past. Admittedly, this leaves one wondering from whence academic scribblers distilled their frenzy.

For something like a year, I have been struggling with a monograph on what the conceptual basis for criteria employed in evaluative studies of this new breed of exotic hazards; I lump under that "exotic hazard" heading nuclear wastes, toxic chemicals and pesticides. Evaluations of these hazards ultimately rest upon some means of predicting the consequences of specific actions and then upon some selection of criteria for choosing among those consequences. My effort has been a very simple one, to see what criteria are employed now implicitly or explicitly for these choices, what I think is right with them or wrong with them, and try to suggest what I think would be better.

It is easier to do this in this kind of abstract way, because you are not burdened by the history of some of these fields. As

many of you know--much better than I--the history of nuclear power regulation in all phases of the fuel cycle has been in large measure a history of rapidly shifting public perceptions and regulatory objectives and of successive industry and regulatory accommodations to these shifting objectives, which, whatever else we think of where we are now, has left us a little unclear about what choices we might have made had we decided much earlier in the game, to pursue the objectives we now hold.

Let me burden you with one more distinction. In reactor safety, you are dealing with low probabilities. Accidents are very rare events, both in our experience and if we give credence to the Rasmussen reactor safety study. And so there really is no data base to depend upon. It is not like air traffic safety or auto safety, where "fortunately" for the analyst there are lots of accidents and lots of data to work with.

Under these circumstances, two kinds of fairness considerations arise, quite naturally. The first kind might be called substantive equity. This is the level of actually setting out criteria for choices among competing technical alternatives. The second kind of fairness, harder for us to discuss, might be called procedural equity, and is perhaps especially appropriate where there is no "firm data base." Very often, the best thing--and the only thing--one can do in these cases is assure that a decision process has certain desirable properties.

Let me now state, in what I fear are somewhat abstract terms, some broad conclusions and generalizations, and then I will come back to highlight the conclusions once again. I have a list of five here.

The first, and this is somewhat impressionistic, relates to some of the claimed special features of the exotic hazards, nuclear waste among them. There seem to be three such special features: one, of the large populations at risk; second, the element of irreversibility; and the third, the possible intertemporal or intergenerational transfer of burdens. These claimed special features are not really as novel as they seem. In fact, in other contexts, we have been dealing with problems like this for a long time, and I think there is a basis for seeing how we handle them--how we go about thinking about them and living with them. This conclusion might be called "the banality of exotic hazards."

I believe there is a substantial amount of evidence which is of direct relevance to the problem of selecting criteria in these exotic hazard cases. I would argue very strongly that, whatever the evidence on risk perceptions, there is considerable relevant evidence on how individuals do accommodate risks and trade in risk, when they have to make trade-offs. And again, individuals have been doing this all

their lives. For example, people who have to choose between bricklaying and steeplejacking choose quite carefully, because the income differentials between these occupations are consistent with the assumption of rational choice among risk alternatives. This evidence, I believe, is useful, in a benchmark way, for talking about some nuclear fuel cycle hazards.

Second, returning to this criterion of fairness: are these ideas of fairness and equity really so new? In a sense they are not, because very few public policy decisions are not profoundly distributional. It is almost true to say that if policy decisions don't have distributional consequences, they won't wind up in the public arena. I don't know of a tax question that is not encumbered with distributional considerations: thus there is considerable evidence on hand--from what we have done in these other cases--regarding what we think is fair, both *intratemporally* and also *intertemporally*: because you can't think about taxation of capital gains--or of capital share of income, for that matter--without thinking about fairness.

A third conclusion is that I believe it is possible to bring these claimed special features of the nuclear waste management problems within some kind of coherent framework, so that, where there is the willingness to do so, the kind of piece-meal and out-of-context analysis of nuclear waste management problems and of other fuel-cycle hazard problems that have been so frustrating and so inconclusive, can be resolved. Here I mean "resolved" in a somewhat restricted sense: you tell me what you believe about future values regarding the trade-off between energy and environmental risk, what you believe about technical waste disposal alternatives, and about what you think is fair intertemporally; then I will tell you whether those beliefs of yours are at all consistent with your position on nuclear waste management.

That question imposes a heavy burden. But, in fact, any time we discuss these questions, we are framing answers to that question. We do it all the time in other nonnuclear places, so we may as well be explicit about this now. It is forbidding, but I think it is better than the next best alternative which, sadly, is incoherence.

A fourth conclusion, which I list as a personalized judgment, is that under what I believe are reasonable assumptions regarding the elements of the problem that have to be specified, the nuclear fuel cycle is dominating an alternative, in the sense that other energy alternatives are almost worse in almost every dimension.

Following these four conclusions, I have a fifth, which I will skip over quite quickly, because I don't have a lot to say about it. I think the heart of our problem in the nuclear fuel cycle and in waste management, is elsewhere. There has been a great deal of talk in some of these sessions about what has been called the lack of

credibility or lack of trust in government. This has been deplored, but I am a little unsatisfied with leaving it at that. I think here, as in other places, we have systematic mismatches of jurisdictional level and decision-making power, and systematic mismatches of organizational incentives and social purposes. These, I think, are the sources of some of our problems of indecision. My own belief is that either we take on the burden of trying to rethink through what our institutional arrangements in this are or--we have never been short of people who will govern us if we don't govern ourselves.

One example may illustrate some of these considerations. As you know, for many many years running, there has been a controversy over low-level radiation releases from nuclear power plants. The standards governing those low-level routine releases have been reduced over time. I think it is fair to say that there is a good upper boundary on the health effects of exposures at current standards. I think it is fair to say that if you look at how individuals value risk in the market where they have to make individual judgments about risk--again, I emphasize that all of us do this all the time, in choosing occupations, appliances, and almost everything else. If you calculate what individuals in the aggregate are willing to pay to reduce low-level releases, it will be far less than what we, collectively, have paid, in capital costs, for those reductions.

What are the uses and abuses of this kind of calculation? My conviction is that it is valuable information, in the sense of at least forcing the question: why are these hazards special and do we want to value them in too special a way? I repeat that I am not arguing that the standards are too high or too low. I am arguing that the question at least has to be faced and it is not being faced now.

My experience, over the past year, in many other fuel cycle hazard areas, has been much the same. I don't think we are facing up to the question of what, if anything, is really special about these hazards. I will end there.

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Mr. MOSS: Thank you, Mark. Any questions of clarification from the panel?

Ms. SHARPE: I wonder whether Mark would go over his last point. It is not clear to me what he is saying to us about the people...when he was discussing the aggregate ruling of some people in the marketplace, in relation to the low-level releases.

Mr. SHAREFKIN: I assume everybody heard the question. Let's enter a dream world, for a minute. For purposes of, I hope, clarity,

let's suppose that the only environmental problem associated with the nuclear fuel cycle was the low-level release problem. Suppose we, in our collective wisdom, or any other institutionalist was asked to set a standard for low-level releases. The easiest thing to say--a nice number that everybody likes--is zero. They liked it in the Water Pollution Control Act, although in some ways it is a physical impossibility. They liked it in the Clean Air Act, because nobody wants to be against public health.

But, all this does is defer the problem. What kind of evidence would you use?

You might look at estimates of the health risks from exposure to low-level radiation, and then you would have to value that against some standard--I emphasize might--in places where you can actually find out what you and I and others are willing to sacrifice in other goods and services for risk reduction.

In our own behavior, none of us acts consistently with the notion that we are willing to pay any amount to lower risks. We just don't do it. We fly. We buy lighter cars then we have to. We ski. We do all kinds of things.

The clearest evidence of this, in my mind, comes out of context where there actually is some payment in kind. If somebody asks me what I am willing to pay for risk reduction, and I don't in fact have to pay anything, then the question is, what would you be willing to pay if you didn't have to pay anything at all? To say the least, I have an incentive to give an exaggerated answer.

When you do look at what people are willing to pay, they are willing to pay, at the margin, about $50,000 for a 1 per cent reduction in hazard fatality. Suppose you had that fact, and suppose that--in our dream world--there were no distributional questions. If you figure out what we should, on that basis, be willing to pay for a 1 per cent reduction of the present standards, that will be far less than the cost of that reduction.

That is not an argument for the conclusion that the standard is too high. To me, it is useful benchmark information, in the sense that you come back to people and ask them if in fact they do want to pay this. And if nuclear hazards are valued differentially than other hazards with the same consequences, then this is entirely sensible.

There are other cases where people treat hazard in very different ways. I like the risk I experience when skiing. I don't like the risk I experience when I am driving around the beltway in Washington, D.C.

I don't think we have ever faced up to some of these questions. Implicitly what we have done in many areas is to value nuclear hazards

very much differently than we value hazards of other kinds with the same consequences.

Mr. MOSS: The second paper will be given by Gene Rochlin, who received his Bachelor's, Master's, and Ph.D. degrees in physics at the University of Chicago. He has been associated with the Energy Resources Program at the University of California at Berkeley since 1973, working on conservation and other areas of energy policy. He is now associated with the Institute of Governmental Studies at the University of California, working on social, political and institutional issues associated with development and use of technology, and in particular with energy supply and use. He has published books on scientific technology and social change, and was co-author and co-editor of the American Physics Society study on efficient use of energy.

"Irreversibility and Multiplicity: Two Criteria for the Disposal of Nuclear Wastes"

GENE ROCHLIN, Institute for Government Studies, University of California, Berkeley

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Mr. ROCHLIN: Rather than try to address the general, large problem of what criteria and goals should be, or what even nontechnical aspects of nuclear waste management are or might be, basically what I have tried to do is to take a very small cut through a very large problem. And I think I ought to state at the outset that the criteria, which I am suggesting in this paper, are not meant to be comprehensive to address all the possible goals of waste management, but they are a set that address a small issue on which I feel there is possibly a consensus.

That consensus is that radiologically hazardous wastes from the nuclear fuel cycle should be separated from the biosphere, to a sufficient degree and for a long enough time, so that they present no significant risk to life. Unfortunately, there would not seem to be a consensus on the definitions of any of the words in the previous sentence, such as, "sufficient," "long enough," or "significant risk." Moreover, the impossibility of predicting socially relevant factors over even such short periods on the time scale of nuclear waste as a couple of hundred of years, precludes accurate estimation of either the probability of an accidental or deliberate breach of containment, or the effects of such a breach on society.

In the absence of coherent goals or comprehensive regulatory standards, the suggested methods for waste management have generally been divided into three categories: short-term storage, long-term storage and disposal.

The definitions have tended to shift from time to time, depending on the document and what year it was issued. But, I would argue that the division of what is properly a continuum of possible methods for waste management to these distinct categories is purely arbitrary.

In fact, if one looks at the record, it appears to evolve primarily as a way to organize technical information in response to external political pressures. This has emphasized the difference between the alternative methods rather than the continuity of the waste disposal problem.

The need for perpetual care, for instance, for a surface storage facility is difficult to weigh against the probability of re-entry of a space shuttle package, or the possibility that there is an undiscovered underwater source of oil reservoir in a salt dome. In the first case, the dominant failure mode is social. In the second case, the dominant failure mode is technical. In the third case, the dominant failure mode is informational.

When you focus on individual methods and their idiosyncratic deficiencies, the debate tends to be a little incoherent, simply because there is no common basis for arguing about the different possibilities for failure: there is no shared basis for comparison. In this way, the commonality of goals and objectives for waste management tends to be obscured.

What I want to suggest are two criteria: technical irreversibility and site multiplicity--but I don't want to give the second quite as much weight as the first. I think the first is a more important criterion.

These criteria are to be used to organize waste management methods on a continuum that reflect isolation from the biosphere in the face of uncertainty. And uncertainty includes, not only geological but social and political futures as well.

I use the word "irreversibility" in this paper in a context which is different from that as I have seen it used in other papers in the Conference. I mean to use "irreversibility" the way I set out here, which has to do with the way the wastes come back to you and not with the irreversibility of the decision process, which is entirely different.

All methods for waste management have to take into account certain things: long-term risks, short-term risks and operational risks, and

cost. In principal, at least, or perhaps in principal, at most, these criteria are empirically determined and then they are used to establish standards for performance that are supposed to reflect political judgments, as to safety and affordability. But, the weighing of the importance of these criteria is a political decision. It involves social and ethical values, political negotiations and a considerable range of other problems, which can be resolved only through the political process and not by technical or pseudotechnical means.

I would argue that there is a persuasive case for subordinating both immediate risks and cost to potential long-term hazards. I take cost to be the least important thing in waste management. As a matter of fact, I don't even use it as a technical determinant, but as sort of an elastic boundary condition that an adequate and acceptable waste management scheme must satisfy. Once you select the method according to consideration of risks, then you can screen it for cost. If you decide it costs too much, you can go look at something else. However, the question is what level of protection you are willing to pay for.

Affordability, price, cost--these are a flexible social and political decision. It is unlikely that costs will be prohibitively high in waste management; people seem to agree on that. And within this range of possible costs and possible risks, you screen out by determining essentially what you are willing to pay for how much protection.

A similar argument is made for subordinating short-term and operational risks to the long-term ones. The immediate risks of disposal operations will be borne by the same population who benefit from the nuclear power that generates the waste. The present can weigh both risk and benefit and make its own decision for itself. This does not mean, however, that immediate risks in cost may not be decreased by exporting the risk. In fact, in many present risks, risks are exported.

One of the famous cases of exporting risk occurs in coal, where coal is burned at the power plant and the risk is exported to the Appalachians where the miners are. This is a standard way of exporting risk within a society.

But, generally, a society has ways for negotiating internally how that risk is distributed. It doesn't always come out right, but in principal it could.

Or, risk can be exported to other populations. You can simply export the coal mine altogether to some other country. And once again, this usually works; in its most extravagant form, it is called colonialism. But, the other populations to which you export the risk usually have, within their grasp, some means of remedying. The future does not.

There is a natural desire to minimize risk and cost. The only constraints, however, on exporting that risk to the impotent future are moral and ethical ones. So, if we are going to watch these areas, we are going to have to behave in a manner which presumably reflects some moral or ethical standards.

Now, I suggested there are two principles of ethical behavior to be followed. The first of these is one which is really derived from an argument by Kenneth Arrow as to what the ethical obligation of a seller is. It is to provide the fullest information possible. Arrow argues that an ethical seller does not withhold information on the marketplace, but provides the maximum amount so that people can choose properly. So, we would argue that the fullest information possible as to long-term risks and future costs should be supplied in the decision making. Unfortunately, the future is unable to act upon this information. But, it is my belief that this in no way absolves us from the obligation to provide it. In a sense, we have to act for the future upon that information. It is hard to imagine how you could do more.

The second principle is to act so as to minimize the amount of irreparable harm that could occur as a result of present decisions. This is sort of a touchy point, I think. It sounds very simple. Act so as to minimize irreparable harm. But, in fact, every action has uncertain consequences for the future. It is not possible to act, particularly in a political context, when you are dealing with more than one person, when you are dealing with groups of people, when you are dealing with extending your present into the future.

Every time you act, every time you do anything, you extend into the future a certain amount of uncertainty, a certain amount of irreversible consequence. This doesn't argue against the right to act, but it does argue very strongly against both the insistence that the consequences can be controlled, which ultimately is totalitarian, and the refusal to take responsibility for the consequences, which has no neat name, but is familiar to most of us.

I define "technical irreversibility" in an attempt to address some of these issues. As I define it as the degree to which emplaced wastes are resistant to recovery or release, either by accident or by the deliberate application of technology. Its significance as a criterion is that the more irreversible a waste disposal method is, the more confident we can be that the waste will remain isolated in the face of both social and technical uncertainties, as well as perhaps, limited or incorrect information about geological futures. If technical irreversibility is high, neither cataclysmic natural events nor the activities of intelligent and technologically adept beings can readily return the waste to the environment or return them at a rate which would cause severe harm.

I have a wonderful example. I should credit Robert Budnitz, who is acting director of the energy-environment division of the Lawrence Berkeley Laboratory, with this one. He said his favorite example of technical irreversibility is when his kids drop a peanut-butter-and-jelly sandwich face down on a sandy beach. That is pretty irreversible.

But, it is reversible in the sense that you could, in principal, go in there with a tweezers and a magnifying glass and get the sand out of the sandwich. There is nothing to prevent you from doing it. It is just that the social cost is too high.

My favorite example of a socially irreversible act--it has been suggested to me that one good example is to create a bureaucracy--but, my favorite example is the pirate practice of burying a treasure in some deserted spot and killing everybody who knows where it is. That, mechanically, is not a very irreversible process. You can dig a hole and you put the treasure in and you cover it up; but socially it is very irreversible, because what you do is destroy the knowledge which is required, the information which is required to allow the retrieval to occur. So, accidental discovery is unlikely, since a deliberate, but unguided search has a low probability of success.

Irreversibility is proposed as a criterion to provide some degree of security against breaching of containment and failure of isolation in the face of unknown social, political, and cultural developments; and to provide the greatest possible security against the release or misuse of these materials by any agent not equipped to recognize or cope with the dangers.

Now, this is sort of an arrogant position on my part, that I am going to sit here and be able to identify in the future who is going to be able to know enough about a nuclear waste disposal site so I will allow them to go in there and take the materials out.

All I can respond is this: we can extend our knowledge and say that, well, we know enough about society to know if a culture in the future, and this could be 10 thousand to 50 thousand years from now, develops roughly along the lines we have, then about the time that they develop, for instance, deep-rock mining techniques, we expect that roughly they will have learned so many things. Since we will have removed most of the fissionable materials, we cannot be as confident that that society, when it develops in advance technology, will understand or even be familiar with nuclear and radiological materials in the concentrated form we have. Now, I can go that far. I can't go much further. But, you can see that with a little careful thinking you can try to extrapolate technical development as we know it and provide some security.

Stability against geological change is a minimum requirement for site selection. It is generally assumed that one is going to look for

a site which is geologically correct and geologically adequate. But, the degree of reversibility also depends on the amount of attention that a site might draw, by its geological features or by identifiable artifacts. Intelligent life is notoriously incautious, particularly when indulging its curiosity. Construction of a large concrete mausoleum, for example, would practically guarantee an invasion of the site. I can't think of anything that would be more attractive to somebody who is playing around and says, "Gee, I wonder what is in that large mausoleum?" On social grounds, I hold that to be quite reversible. In fact, additional irreversibility cannot be provided by warning messages, symbols, or labels. You can't assume that even a society that has the technology to undo irreversible storage will know enough about radioactivity to proceed cautiously, or that they will be able to decipher a message they can't read.

And again, I have a favoriate example--Linear B, a language which was around for many thousands of years, and which in fact took 50 years to decipher. There is a wonderful book by John Chadwick called, "The Decipherment of Linear B." They had all these jars, and my favorite story is, suppose the labels on these jars said in Linear B, "These jars contain a terrible deadly poison and if you open them you will drop dead." This is the sort of thing that you can do when you try to provide labels.

Technical irreversibility, then, is defined by a combination of social and physical elements. It is supposed to measure both the size and the sophistication of a technology or natural mechanism that would return the waste to the biosphere in quantities or at rates that would be radiologically significant. It does tend to correlate fairly well with scientific and technical aptitude with sophistication in other things.

Okay, so you get yourself a technically irreversible site. Why have I put a second criterion multiplicity--when we could all go home? The answer is, I am not all that confident that we know what we are doing. There is always going to be a certain amount of uncertainty as to whether the method you chose for waste disposal is technically sound. Or, in fact, whether you have been able to think through all the possible ways by which a site might be breached.

If a single-site, single-technique method is used, you get the question: How strong does a basket have to be before you are willing to put all of your eggs into it? One way to handle this is to provide a lot of baskets and spread your eggs among them. The provision of additional baskets has two dimensions--multiplicity of sites and diversity of options. I will address "options" a little later; this corresponds to saying maybe all the baskets that I designed will fail simultaneously and for the same reason, so maybe I ought to build three or four different kinds of baskets as well. The purpose in either case is to hedge against uncertainty and ignorance by means of redundancy.

For instance, the irreversibility of many types of geological disposals could be increased by making the number of sites very large. This would reduce the potential risk due to the breach of any single one. An alternative approach might be to collect many years of production, get a giant site, make it so deep and so strong and so reinforced that you are absolutely sure that that site is not going to be breached. However, if you are wrong, the consequences are very high. I would hold that under the specified conditions, multiple emplacement confers more technical irreversibility by my definition, in the face of uncertainty as to social and geological futures.

It may be argued that in fact, by doing so, you increase the probability that something will be released. And this is entirely possible. If you have a whole lot of sites, you may be guaranteeing that one of those sites will fail. And then one has to look at the damage that is done, and ask whether there is almost certain probability that there will be a low-level release. Essentially, it is the trade-off between the low-probability, high-consequence accident and a whole series of not-too-low-probability, but not-too-high-consequence accidents either. You have to look at the inventory in the sites before you can make the decision. It depends on when you predict the time, what the release of material is, how many people you may think will live in the area, and a whole number of other things.

Multiplicity of site does not, of course, provide security against fundamental conceptual or design errors. If you are fundamentally wrong about what you think about containment, you haven't gotten anything by making a lot of them; but it does reduce the consequences of deliberate or inadvertent action of intelligent life.

Both technical irreversibility and site multiplicity are desirable criteria for evaluating waste management alternatives, and they can be used in some way to screen them. For any type of nuclear waste, a set of combinations of the two criteria can be determined that bounds the region of acceptable waste management. That is to say, I will set a minimum condition for irreversibility and for multiplicity as a combinatorial factor and say, this is my minimum, anything which exceeds this, I start looking at other criteria to evaluate it.

It should be kept in mind, however, that our obligation to the future is also supposed to extend to the preservation of option as well as to the prevention of harm. We have an obligation to try to avoid irreversible consequences of our actions. In that case, it may be more desirable to dispose of the waste by a method that is not entirely irreversible. For instance, a method as roughly irreversible as present uranium ores for disposing of spent fuel, would essentially say, "Okay, I have no present use for spent fuel and I don't want to reprocess, why are my only alternatives to throw away or reprocess?"

Why not put this in what amounts to an artifically-created ore

bed and say to the future, "You can go get the plutonium out of the ground, with not too much more time and effort than we spent with getting the uranium out for our fuel cycle." Or perhaps, you want to say, "Maybe you ought to be a little more careful with the plutonium than I was with uranium."

But, whatever you want to do, emplacement is possible that is not beyond potential recovery; it would entail considerable cost and effort, it would not be impossible.

And again, these criteria could be used to screen that, to set up the line which is roughly comparable with present ores. Somewhere in this range, between the minimal acceptable and the maximum irreversible, there are methods which exist. You can then look among those methods according to your secondary criteria, operational safety, cost, and many others. Basically, that is my suggestion.

As for diversity of option, it is supposed to provide you with *more than one way in case you have a fundamental design error.* What does equivalent between two options mean? On this criterion scale, I hope that you can say both of these are roughly equally irreversible, if for different reasons. I like them both about equally well, and why don't we split the waste between both of them, perhaps? On this sort of continuum criterion screening, along these or similar lines, it might be possible.

I have suggested two criteria, which have been constructed specifically to address the reduction of future risk in the face of inherent uncertainty and to provide for safe disposal without requiring the guarantee of future ability to recognize, detect or repair areas of failures.

Decisions as to how to apply or weigh these criteria, in conjunction with other waste management criteria and goals, rest ultimately with societies and their governments. My purpose has not been to preempt the process, but to try and construct the framework that facilitates consideration of the ethical and normative components in a consistent and systematic way.

As with many other human activities, the production of nuclear power entails risks for future generations who have no voice in the present. On that account, their welfare should be carefully considered. It is not within our power to pass on to the future a world unchanged by our residence in it, nor is it clear to me that we have an obligation to do so. But, as our every act affects the future profoundly, our minimum ethical obligation is to examine the consequences most thoroughly, to acknowledge them openly, and to minimize the potential for irremediable harm

That obligation is not satisfied if we impose upon the future an obligation to provide for social institution stability, which is unprecedented in history, or if we attempt to transfer the responsibility for repair or clean up from our shoulders to theirs.

There is no ethical or moral basis for placing social and technical requirements and obligations on the future for the sole purpose of protecting them from our actions. The obligation to consider the effects of errors in our technology or in our judgment to provide for inability to guarantee future technical performance, and our obvious inability to guarantee social stability and cultural continuity, in fact, rests with the present. And my basic premise is that an ethically sound waste management policy should have criteria in it that not only reflect our knowledge and our skills, but in fact, our limitations as well.

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DISCUSSION PERIOD

Mr. MOSS: Any questions of clarification? If not, we can open the discussion to substantive questions and comments.

Mr. VARANINI: I would like to make a few comments concerning what I think this process is all about, and some of the confusion that may be going through the minds of the public that are here to observe the process. I think it may be a result, somewhat, of the latest pop kind of academic investigation--a concept called "quantum logic." That is that man's thinking processes must be expanded beyond linear and sequential thinking. Its historical equivalent is saying that Aristotle is to logic as Archimedes is to the quark or other unknown components of basic matter. So, basically, I think, what you have been presented with, and what we are presented with on this panel, is sort of a gestalt. Where are we right now? What are we trying to do here? And what are we going to do that the next panelist can react to?

What we have done is, we have separated technology from policy, goals from process, and process from implementation. We are being subjected to sort of an economist's approach to tell us that praedial optimal transactions, which don't take place in the real world anyway, can't even theoretically deal with intergenerational transactions, or transactions between us and our grandchildren.

So, it seems to me, what we have to do is go back to yesterday, to the process that we were exposed to and which received, I think, significantly short shrift. The NRC paper of yesterday represents the best way, in my view, to avoid enslavement of policy by theoretical economic considerations, including intergenerational optimality, hoteling rents, and other such processes where economic scarcity cannot exist, by definition; yet resource scarcity resides, because of reality.

I prefer to discuss the uniqueness of the process that the NRC task force set forth, and to expand on the results of their study. You don't have that study before you; and so, in essence, you have been asked to react to something that you haven't seen. So you have been subjected, in some sense, to a verbal barrage from a multiplicity of viewpoints without understanding, I think, the basic thematic document to which this panel is being asked to react.

I personally applaud and support the NRC task force paper because real-world decisions have to flow from intuitive models rather than hiked quantitation. And basically, at least, this intuitive model sets forth explicitly what its assumptions are. I think that if we set forth that intuitive model, then the second group which we are going to discuss--organizations and responsibility--will have something to talk about relative to goals and policies. And finally, the third group, which is going to talk about possibility and impossibility to implementation, will have something to react to in sequence.

And, at least, I will be able to go away from this conference with an idea that we went from A to B to C in terms of process. This report by the NRC task force is very blunt and very tough. It will be heavily resisted. And I think it is up to the people that are here today to support it because if such support is not forthcoming, we will have merely another stereotype of the historical stalemate that is going on currently in nuclear power.

Secondly, I want to make sure that you understand, you in the audience understand, the significance and the importance of this NRC document. Believe me, as a person who has to intuit to some form of regulation, which we glowingly refer to as the Socratic method of regulatory processes, I think it really does set forth some very, very important things. They are things that you should react to, think about, and in my belief, you should support. You should particularly support them if you have been critical of the public involvement and the credibility of the process.

It is very difficult to try to go through this thing, but it has some very pithy comments in terms of policies. Mr. Chairman, at your direction, I think it might be relevant to try to summarize them again, so that they can be refreshed in terms of where these policies may fit, where we may be going and how the next panel interrelates, one to the other.

Mr. MOSS: I would like to take some time to do that, but I prefer to do it towards the end of our time today than right now. I think we ought to address a few questions to the authors.

I would especially like to ask Gene Rochlin to comment on how the criteria he listed and the trade-off he described--for example, the trade-offs involving probabilities of releases and consequences of releases in deciding on an appropriate level of multiplicity--how one would make decisions about things like that. Would you regard this largely as an intuitive process, or as a process in which an attempt was made to quantify these probabilities and consequences?

Mr. ROCHLIN: I think that is a rather difficult question and I am afraid the only answer I have may be a bit lengthy, but there are a combination of factors that enter.

In terms of the quantity of material for a waste site and the effects on life, and you have the ability to go in with quantitative methods as best you can, you can try to determine that there are ten to the minus sixth curies per cc and one thirty-seventh in this site, or something like that, and if it is released at year 442, how many curies will there then be? How much biological damage does that do? And from that you can start to estimate what it would be.

But the problem you run into and the reason why the quantification never works is the next assumption you make--where the people are and what are the pathways? The method has to be applied differently, I think, to different kinds of waste. For fission products in short-term, short-lived things, you can behave fairly confidently about your pathways and your population distributions and try to calculate effects and impacts and then use that as a screening to go back and determine some of the parameters for the irreversibility. You can determine for short terms, relatively short terms, into the future. You can behave with some confidence about the degree of irreversibility of your emplacement. But as the times get longer, your uncertainty increases and you have to start behaving more, what I would call, pseudo-quantitatively, which means, you act as if you know, but in fact what you are doing is behaving relatively intuitively.

Now, intuition can be guided, certainly. We have the classic cases of salt formation. As someone said, it has existed for several hundreds of millions of years, and so you are relatively confident that it is going to exist for the next 10 and for the next thousand and perhaps for the next million. Your confidence in that information essentially decreases with time. Again, that depends on the formation.

If rock formation is your confidence in predicting the future from the past is higher because you have a quantitative erosion mechanism for deterioration, you can start calculating how fast could

anything go wrong. And again, you are behaving as if you could quantify--and my warning is that, in fact, you behave intuitively in a lot of circumstances where you would like not to behave intuitively. And what should not be done is to pretend that that intuition is in fact not intuition at all but calculation.

Mr. RODGER: I would like to say a couple of things about this whole process which Dr. Rochlin is talking about, which I think is really very interesting and very good. There are two terms which are used in your paper--isolation and containment--and you seem to use them interchangeably. We all do this, and I believe they should be defined quite separately, and I will do so in just a moment.

And then there has been a theme running throughout here that the long-term problem far outshadows any short-term problem. And I think this is wrong, vastly wrong, and I would like to explain why.

First, for the definitions: I think "containment" means keeping the waste within the confines of whatever place you put it. And "isolation" refers to the selection of that place in such a way that it is hard to find. They aren't the same thing.

Now, I believe that an awful lot of the thinking about this whole waste disposal problem is confused because we lose sight of what our goals really are. Very simply put, I think there are two goals, and we are trying to do one or the other or both...probably both. The first goal is, you are trying to assure that the public is adequately protected in relation to its supplies of air and water. And the second goal is that you are trying to protect an individual from harm to himself by intruding into that waste.

These are two very different problems and I think we get into trouble because we treat them as one. The first goal, that is the protection of the air and water, and that means for all times that that is a sine qua non. If a method that we want to use can't do that, you can't use it, that is all there is to it. But you should recognize that this goal doesn't demand isolation in the way I just defined it, and it doesn't require absolute containment. It requires containment along the lines of the definition which you gave in your paper, that is, that the degree of containment must be high enough so that it gets back slowly enough and in small enough quantities so that the air or water is not contaminated or made noxious.

You make the point that there is a difference in different kind of wastes and I agree with that. But for most of the waste that we seem to talk about, with the exception of pure transuranic wastes, the achievement of this goal, the protection of the air and water, is completely dominated by the fission product content...

For wastes of a reprocessing origin, this domination is typically by factors of a hundred to a thousand. And this means that the demands of the system to meet this goal are a factor of a hundred to a thousand greater for the fission product content than they are for the transuranic content. It also means that by the time the transuranic content becomes controlling--which is a matter of two to three hundred years, something of that sort--the hazard potential for meeting this goal has dropped by that same factor of a hundred to a thousand. Furthermore, it has dropped down to the level of the ore body from whence it originally came.

I believe it should be possible to maintain some degree of control over a site for some, perhaps all, of that time, and to assure that you have indeed provided the degree of protection that you think you have. And by that I don't mean simply that nothing has happened in the two to three hundred years, but that you have been able to make enough measurements to narrow your uncertainty band in your calculations so you can say indeed it is behaving the way we expected.

So it seems to me that if you provide a system which meets this goal for this period of time and until it has decayed down to the levels of the ore body from whence it came, you have provided it for all times. I find it very difficult to conceive of a process, geologic, galactic, any way you like, that will now disperse it in such a way that it does not involve the use of either large amounts of energy, large amounts of diluent, large amounts of time or combinations thereof, and that the concentrations will then not be all that bad.

So, the primary goal, that of protecting the air and water, is a short-term problem, and I apologize for talking about two hundred years as a short-term, but it is the short-term as opposed to the long-term problem. And note that the criterion that is involved here is the inventory of the amount of material that you put away. And this argues, in a way, for your multiplicity of sites.

Now, the second goal--that of protecting individuals from harming themselves by intrusion. This is dictated completely by the long-term complements; the transuranic complements. We could assume, really, rather than fight about how long that should be, that anything that hasn't decayed in a hundred years ought to be considered stable and there forever; and we treat the problem for the end of the hundred years as though it were going to be there forever.

It is here that it is important to provide isolation. You want to keep an intruder from getting into the material. And what counts is how much of the material, how much the activity might get into the intruder. There is a physical limit to how much he can take into his body and, therefore, that needs to be followed through to see what

can happen to him. In this instance, the amount of material doesn't matter; what matters is the concentration of these long-life materials.

For the first problem, which in effect disappears in a few centuries, we are worried with quantities. For the second problem, that which in effect goes on forever, we are worried about concentrations. If we make that distinction, we will be able to break this problem down into soluble portions. I recognize that the public doesn't perceive the problem this way, but I say that is because we have failed to describe the problem properly. And I don't blame those who have blown the problem out of proportion, I blame us technologists who have let it happen.

Mr. ROCHLIN: Let me react to the first part of that first. I agree with you and I am sorry if I gave the impression in the paper that isolation and containment should be treater interchangeably; in fact, they are two quite different things. Again, both of them contribute to what you want to do and, in fact, you may choose a different balance between isolation and containment depending on what sort of wastes you are getting rid of. In a sense, for the high-level waste disposal and salt, as we discussed yesterday, there is no containment--really, it is isolation--because the containers, per se, disappear. The idea is that it is in the salt bed where it is fairly remote.

However, on the other points, I am a bit reluctant to open too many cans of worms, but--okay. I think the statement that it decays to the level of the ore body from which it came, is a deliberately and maliciously misleading statement that has been constructed by artificially taking the volume of the entire disposal area and averaging the concentrated packages of radioactive wastes over that volume.

I have seen the calculations and I have seen the papers that do this. It is true that the fission products in less than a thousand years decay away to harmless levels. They decay way below the natural 0.2 per cent uranium ore before a thousand years. Somewhere around six or seven hundred years, more or less--it depends on whose calculations you use--somewhere out there in the several-hundred-year region, a cross-over occurs where the actinides and their daughters take over as the leading terms in risk and hazard indices. (And I am accepting the present ICRP values, which I am told may be revised upwards by a factor of five this year, but a factor of five isn't going to hurt one way or another.)

At one million years, out...a high-level waste, solidified package according to some calcination and vitrification process...you have to take an average number because the densities aren't always the same... the hazard index in cubic meters of water to dilute that waste to the radiation concentration guidelines is something like three thousand times higher than the 0.2 per cent uranium sandstone ores, and something like a couple of hundred times higher than four per cent uranium

ores; in fact, out of the million years, it is roughly comparable to pitchblende.

Pitchblende happens to be a very hazardous substance. There are more radiation deaths recorded than weren't identified, because they occurred largely in the past. There are more radiation deaths recorded from accidental mining in the vicinity of pitchblende, particularly in Czechoslovakia than there are from any other cause of radioactive death or illness with the exception of nuclear war.

The point is, that when you drill into these formations, you drill into the pockets. You don't necessarily drill into the average formation. And unless you are planning to grind the waste up and distribute it uniformly throughout the bed, then I will specify the RCG hazard index is as low as that of the ore from which it came. But, in the present disposal method, it is like a plum pudding and it is not fair to say that each spoonful of pudding contains .001 plums; you either hit a plum or you don't.

Mr. RODGER: You are still missing my point, Gene, and that is, that from the standpoint of the protection of public water supplies, the concentration doesn't matter. It is only the total quantity that is there.

It is true that we took the material from a fairly large volume and compressed it down into a small volume and it is because we did that, that indeed, the concentration is higher. But, the fact that we have done it does not change the relationship to the drinking-water problem...But the point I am trying to make is that we are dealing there with a problem which involves individuals, not populations. And it is only that a problem which extends beyond a relatively modest time into the future, that the sort of thing that one tends to try to use the word "catastrophe" about, which I would say had to involve large groups of people, does disappear in this two-to-four-or five-hundred year period. The concentration problem doesn't disappear forever, really, in all practical terms. I am trying to get us to separate the problem into its two pieces which are quite different.

Mr. MOSS: Before I call on Ida, do you find that a satisfactory presentation of the problem, Gene?

Mr. ROCHLIN: I don't have enough major disagreements with that to make it worth picking it up now.

Ms. HOOS: Well, it may be totally out of order for a peon on the panel to make this kind of comment right now, but I should really like to say that from my observation of what we are doing, we sound very much, to me, like the gentlemen of Hindustani in that we are all looking at the elephant and we are all seeing it differently. We are all in the right and we are all in the wrong and we are going

to continue to be for the rest of the morning.

Therefore, I really should like to do something that may be totally inappropriate, and that is to suggest to our chairman this morning that we do owe something to posterity at this conference. And we should take somewhat more seriously Gene Varanini's suggestion that we try to move ahead somewhat and lay the groundwork, so the coming sessions will be totally fruitful, instead of, at this point, retreading, going back to what we know already and what we will only be finding more right and more wrong about before the morning is over.

Mr. MOSS: I do like this idea of going back to the goal study and maybe even reading individual goals that are in the study to get a panel reaction to them. I don't think the audience has that in front of them, and they can get a flavor for the specifics and the reaction of a diverse group of people to individual goals, if we followed that procedure. Do you have a suggestion to make?

Mr. VARANINI: I think that the very debate that was just going on here--if it is a debate--between the technical people, is sort of an indication of one of the things that the goals report tries to do. I am a generalist and when someone asserts that we put all the uranium or all the waste on a highway from A to B, it is four feet high, versus someone else saying it is two garages full by the year 2000, I have to take the technical people somewhat at their word until I do some kind of my own investigation.

I think the important thing is that the goals report sets out not just goals. One of the things we found was that there tended to be sort of two schools of thought in how to proceed in these matters. One is the planning school; what you do is you say, "We will have a plan on waste disposal; we will adopt a plan and then all decisions will be taken in accordance with the plan."

It is the biggest legislative drafting cop-out known to man. And you will see all kinds of things done that way.

The other way is a process; one in which these kinds of debates can be resolved and the process itself can be described as being either fair or unfair. I think that the report by the NRC task force is misnamed; it is not just a goals report--it really recommends a process. I would hope that the chairman would want to go through and set forth that process so the people in the audience have an understanding of it. And--I hope to God we get the thing out sooner or later so that they can comment on it at their own leisure.

Mr. MOSS: Well, let's follow up on that by reading one of the first recommendations of the goals report which does deal with process, and get a reaction from the different panelists. It reads

as follows: "Procedures shall be established that can be used to assess thoroughly the issues involved in making decisions regarding nuclear waste management and to furnish opportunities for full participation by the public in the decision-making process."

There is a footnote explaining what is meant by public. It is "groups or individuals that have a particular interest in the outcome." There is a sub-recommendation under that: "The existence of scientific, technological and organizational uncertainties in any waste management system shall be made explicit along with the logic and procedures used to address these uncertainties." Comment?

Mr. VARANINI: I would like to comment on what precedes that--the finding that the conceptual framework and the data basis for generating regulations on waste management are deficient.

It seems to me that is the real reason--what we are here for and why we are proposing something: Is this something new or is it an agglomeration of current rules, regulations and processes?

The report says that the present system is deficient, that uncertainties will remain on such fundamental technical issues as geologicability, isotopic migration and even greater uncertainties in terms of nontechnological aspects of the system; I think that is an important first premise and I happen to agree with it substantially. As a matter of fact, we are mandated by law in California to assume that posture. So, I think it is a very important first premise and I think that that first goal is reacting to that first premise.

Mr. MOSS: Do any panelists disagree with the first goal that I read?

Mr. RODGER: I disagree at least with part of the interpretation of it. There are indeed some extensions of existing both technology and regulatory frameworks that need to be done. But, the implication that there is an almost starting from scratch, is certainly not correct. The Nuclear Regulatory Commission has in place and in being ways of developing and administering regulations, and while they may indeed need to have some extension and additions to handle the special portions of this problem, they are not completely starting from scratch. As far as the technological base is concerned, we have so much of it that we are offered a multiplicity of choices and we might be better off if we had a few fewer. So I don't agree with the implication that we are starting off from a very deep hole in the ground. We may be starting off from a depression, but I would disagree to that extent.

Mr. MOSS: But that implication is not in the goal statement itself.

Mr. RODGER: No, it is not in the goal statement itself. It tends to be in the additional material which Mr. Varanini was referring to.

Mr. MOSS: Mark, you had a comment?

Mr. SHAREFKIN: Yes. Gene Varanini, I am a little mystified by some of your comments. Are you saying that whatever outcome that process arrives at, that on some intuitive or other basis, you would find that outcome acceptable, irrespective of whatever criteria you may feel are applicable in these situations?

Mr. VARANINI: I think we may share a common base of mysticism because I am as mystified perhaps as you are at some of the comments. But, being Italian, I guess my intuitive tendencies may be a bit stronger than others. What I am saying is that the process has to resolve real issues. You can't sit down and design artifical or abstract criteria and then reach a conclusion that the conclusions, basically, the process is that resolution of technical and policy conflicts. You don't know what they are and I don't know what they are. That is the highest degree of elitism that I can think of--to assume I know everything about everything and I will resolve the issues by a set of criteria.

What I am saying is you have to have a process which engages the issues and then you resolve them. We have only had about thirteen hundred years of resolving some of these things in common law, so people don't beat on each other with sticks. It seems to me that that conflict resolution has been reasonably well done; however, it is evolutionary and the final step in evolution is extinction. So, I would just say I would prefer to put it in terms of criteria and process. And I don't mean to be pre-emptive about it.

Mr. MOSS: But you are giving more weight to legitimate, open, accessible process than to the specific objective criteria dealing with a particular problem?

Mr. VARANINI: I think the process is sort of the first place that then erodes or evolves, depending on which definition you prefer, into a routinized kind of process. I think it is this idea that someone perhaps didn't think about the steam problem of a floating reactor going through the bottom of the vessel into the sea. You know, sort of a common laymen's kind of interpretation of that problem. But, the common understanding is that someone didn't think about it--or if they did, they didn't include it in the paper--and things like that. You tend to fill in a lot of those holes and it really reduces the technical arrogance of many of these processes.

Mr. MOSS: Well, I think it is a good point that is often overlooked. Many of our panelists have stressed it--that feelings of

dissatisfaction with the process may be as important, or more important, than particular objective criteria and decisions.

Ms. HOOS: One of the things that we looked at very closely in the process, which is what Gene is talking about, is the way in which decisions have been made. And the methodology. As you know, the core of the methodology is cost-benefit analysis. And cost-benefit analysis has certain kinds of built-in rigors and limitations.

I was interested to read Lynn White, the historian, and his view of cost-benefit analysis as applied retrospectively. You can see how terribly wrong you could have been if, for example, in the past you applied cost-benefit analysis to some of the things that we take very much for granted in our civilization today.

I just want to tell you two of these. Once you translate these into future terms, you can see really on what shaky grounds you are in sticking too closely to the rigors of the mathematical model that you develop when you do the standard cost-benefit analysis, that certain things have to be plugged in and have to fit, and the rest is totally a procrustean thing.

Procrustes was the innkeeper who had an inn; and the hapless traveler who happened to get there, if he fitted the bed, that was fine, but if he wasn't quite big enough to fit the bed, Procrustes stretched him to fit it, or if he were too long, the ends were cut off. This is the Procrustes method and that is cost-benefit analysis in the present mode.

Lynn White in his speech, to his historical society, suggested that it would be a very interesting exercise to apply cost-benefit analysis to the development in Salerno of brandy, the distilling of brandy out of wine, because at that time this was considered about the greatest thing that could have happened in medicine, because brandy was very useful for curing dandruff and tics and fallen arches and rheumatism and just about any problem known to mankind. And so this was great. But, within the next 500 years, liquor and hard liquor had become such a scourge in northern Europe that already in Frankfurt am Main there were all kinds of regulations and ordinances about drunkenness and the problems of the drunken person.

Lynn White brings it up to the present day and asks you, the reader, to do a little bit of a cost-benefit analysis about the conviviality that is contributed by having liquor at meetings such as his. I won't say anything about present company. On the other hand, he also took you out and let you look at the carnage on the highway. This was just one example.

Another example that he gave us was the development of the chimney flue as being a very important factor, not only in architecture, but

in lifestyle, to the point that the great families no longer all lived with servants and beasts by the fireplace in the main hall, but in fact, that they went off to different rooms. Lynn White makes the comment that this had more to do with the development of the art of love than did all the troubadours known to history.

I would submit then that we have some thinking to do, not only retrospectively, but about the future and the methods used. And this methodology was one very serious area of concern for us that comes under this heading that Gene Varanini has mentioned in the process of arriving at some of these goals.

Mr. GUTMANIS: Let me go back to my comment yesterday about Bill Bishop's paper in which I expressed considerable dismay. Let me repeat the dismay. Right now we have a statement from Miss Hoos which says if we looked at cost-benefit analysis as they looked in evaluating the goals...let me assure you that those goals as stated right now do not reflect any cost-benefit analysis. For all I know, every panel member, perhaps, spends endless hours, months, years, agonizing about cost and benefits of those goals. If so, they certainly kept them secret, because the goals as stated do not represent any consideration of cost and benefit.

My next comment is, apropos to this, Gene, just minutes ago in his paper, stated to the effect that costs per se are of secondary importance. There is a general consensus that they are not very important in the state of affairs. I would like to disagree with that. Perhaps they are not very important for the United States. When you do deal with other countries, which are going to go into the nuclear problem area sooner or later, and already in it, the costs of disposal are severe handicaps on them. I am really worried about it. I think we should consider that particular point.

Mr. MOSS: Ida, did you want to respond to the point about whether cost-benefit considerations were included in these goal formulations?

Ms. HOOS: I thought it was clear that we didn't feel that under the circumstances and by the definition that we could or had to, because the point is that what we were thinking of is the full range of cost and benefits over a much wider spectrum than that which is available to any mathematical model that we have seen presented to us.

Mr. BISHOP: Let me make one comment and that is: Ivars, as I understand your predicament in reading through the goals as written, yes, it is very brief. It was intended to be a summary document. Yes, there are a lot of things that we wrote internally as working papers amongst the groups. We are working on those now and intend to include many of them as appendices to the document. They weren't

available to you...for that I apologize. The fact of the matter is that we intended at this session to have a summary paper.

Mr. MOSS: Let me go on to read another goal...Lois?

Ms. SHARPE: I would like to support the statement in favor of emphasizing process. I think that all of the speakers who opened the session yesterday and much of what was said earlier in the presentations yesterday, emphasized repeatedly the importance of the dealing with the social and political side...that these were social and political decisions as well as technical and economic decisions. The only way, I think, in which the social and political system can enter into this system is through the discussion of process. I do not see that a presentation of the uncertainties, which certainly must enter into any social and political decisions, I do not see that this necessarily means that we have to go back to square one. In discussing uncertainties, the immediate set of things that you have to get out of the way are the things you really know. That is the only way you know what is still uncertain.

Mr. MOSS: Okay. Let's go on to another goal. I will read it. "Decisions and actions shall be based on assessments of the impacts on both present and future physical, human, and societal environments. Organizational and institutional issues shall be included explicitly " Comment? Mark.

Mr. SHAREFKIN: Let me make one comment about some of the things that have been said about analysis, because I think they really missed the point. Ida, nobody I know who does cost-benefit analysis does it in ways that might be inferred from what you suggest. And I think its main benefit, if any at all, has been in imposing certain constraints on the kinds of discussion that go on.

Now, I have trouble knowing what a goal of this kind means in any real terms. By the time that thing is specified, some trade-offs will have been made. My only feeling of the uses of analysis, Ida, is that they are made in some kind of informed way.

Could I make one comment about the question of process, Larry, because, you know, which process are we talking about? Would anybody on this panel want to take a position that the outcome--let's say of the licensing process that we have had in light water reactors for many, many years now--has been a good outcome? One view of the regulatory process, Gene, which I think is the process you were talking about, is that it has been convenient to take some distributive decisions that really belong as legislative decisions, and kick them into another framework, so that the legislative responsibility does not have to be taken. I believe that from a basic value judgment of representation that some decisions are properly legislative, but I

have a lot of trouble in the nuclear field, on the basis of experience, attaching any sort of validity to something that comes out of a regulatory process.

Mr. MOSS: I think what you are saying is that you are not satisfied with the process as it exists, quite apart from whether the outcomes were the correct outcomes in terms of objective criteria.

Mr. SHAREFKIN: With the location of that process in essentially the goal-setting process and the regulatory framework, no.

Mr. MOSS: To go back to this goal, does anyone object to considering both present and future environments, or having organization and institutional issues included explicitly?

Mr. VARANINI: I think it is important to recall that the reason is generally that the next panel is going to have to tell you whether it is possible or not, or to the extent, if you mini-max it to the extent you can do it, or do we know how to do it? So, I think it is relevant to make that point on all of these.

They may sound a bit bland, but my definition of process is how in the hell do you implement them? That is process to me, and process contains criteria. So, I don't think it is a mystical experience; I think it is a rational one. It doesn't seem to me you can start with criteria unless you want to establish that criteria in private--which is another major criticism of the current regulatory process, that basically what goes on is someone proposes a new program and then has to literally conduct a private transaction to explain to government what it is they want to do. Then government makes some form of private decision in terms of rationalizing that new process and then finally goes to the public and says, "What do you think about the product?--and, by the way, we will defend it to the death." So, let's just keep the thing in some perspective. These things have reality in terms of what these next panels are going to have to grapple with.

Mr. MOSS: Harold Green can consider himself on notice that he has to cover all the things we didn't resolve.

Let me read another goal. "Values not easily quantifiable shall be actively considered in the decision process." In other words, intangibles have got to be weighed. Any disagreement with that?

Seeing none, the next one is: "There shall be broadly based involvement of interested groups, jurisdictions and citizens in decisions and in the planning process." We had quite a bit to say about this yesterday and I sensed agreement on that point.

The next one is: "Other than federal jurisdictions, for example,

states and local government, shall be involved from time of inception of ideas to implementation of the waste management system."

Mr. VARANINI: My view on that is, if that doesn't take place, the states will invent a way to participate.

Mr. ROCHLIN: I would just like to make a comment at this point that really amounts to throwing myself on the tracks of the last train that charged through here. I think that the distinction is getting muddied in here again about the criteria and the process, which is something Gene Varanini set out in the very beginning. There are two things about a process that has an unsatisfactory outcome that one ought to think about. One is that you are unsatisfied with the outcome. And another is that you are unsatisfied with the process. You have to be careful not to throw the process out because something happened in it that you didn't like. Some of these things address how the process might be carried out, other than try to restructure the process by which decisions are made. I think it might be very useful to try and think about making a more clear distinction between things that are goals in here that are meant to facilitate, improve or clarify the process of making decisions and other suggestions which are in fact attempts to restructure.

Mr. RODGER: It is hard, it is impossible to disagree with the goal. Certainly the states and other groups are going to--and should be--involved and I agree with Mr. Varanini that if you don't, the states will invent one. I only suggest that it would be nice if we came up with some innovative inventions which succeeded in putting them together into a--if not a single--more cohesive and coordinated proceeding, because we are wasting a tremendous amount of everybody's time and effort in going over the same ground many times.

Mr. MOSS: Let me read another one. "The organizational infrastructure shall be able to respond successfully to both gradual and abrupt changes in the rate and scale of activities." Comment on that? Lois.

Ms. SHARPE: This seems to me to be eminently desirable and I wait to hear how the next panel is going about implementing this. Doesn't this seem to be what we might consider bureaucratic and administrative, whether on governmental administration or whether for corporate administration? Paradise would have been attained if we could reach this goal.

Mr. MOSS: Well, at least we know which direction paradise is in.

Okay, I will read another one. "The collection, treatment, intermediate storage and transportation of radioactive wastes shall be performed in a manner that provides reasonable assurance that the public

health and safety will be protected. Procedures will be developed for assuring that any unintended incident at this stage can be dealt with adequately." There are some of those words cropping up again that you referred to before, Gene--"adequately," "satisfactorily." Any comment?

Mr. VARANINI: I just have a comment that, you know, one outcome is that we can't do this. I think that is a whole other point to keep in mind. One thing is to say that the goals are such a level of generality that they are meaningless. And the other one is to say that they are at such a level of generality that they are totally meaningful. If your view is we can't attain this, then you have to start thinking about what the alternatives really a: both in general systems and in specific applications. I think it is something to keep in mind, not to just say the words are an inherent internal hedging strategy that can satisfy any outcome.

Mr. RODGER: It seems to me that this particular goal addresses operations which are going on now. These are operations short of ultimate disposal of the waste, the shipping of them, the packaging or the transfer of them. And they are all covered by regulation rate now. I don't have any objections to the goal; but I think this not only can but is being done.

Mr. BISHOP: I would like to respond to that very briefly. A point that I made and maybe got lost over yesterday in my presentation, is that where we went looking for goals was in many respects in on-going programs by asking the simple question, "Why does the program have this direction or focus?" There is no explicit intention to say in the document that many of these goals are not already being addressed with existing programs; they are, in fact.

Mr. MOSS: The next one is...by the way, all the ones I have read so far, and the next few ones, deal with the shorter-term problem. You remember Bill Bishop yesterday divided it into three time periods. We will get to the intermediate and longer-term goals later.

VOICE: Larry, we have a question here.

Mr. MOSS: Well, is it really urgent? We have a fair amount of ground to cover. Why don't you write a question or a comment down like we arranged to do yesterday and we plan to do today, and pass it up. And then we will attempt to cover it...The gentlemen is saying that the method of asking questions and making comments from the audience is not terribly effective because of the filtering process.

Well, almost any method we chose is bound to have some inequities and some disadvantages as well as the advantages. For one thing, if we had everyone present their comments and questions verbally, I suspect we wouldn't be able to cover half as many comments and questions

verbally; I suspect we wouldn't be able to cover half as many comments and questions as we could cover if we have an initial screening and a segregation of questions in the particular areas. I would prefer to go on. Maybe, if you feel it is important, we could get back to this when we open it up to questions and comments from the audience.

Okay. "Efforts shall be made to minimize the fraction of radioactive wastes which are dispersed in effluent streams and to channel as much of it as practical into a waste stream which can be captured and contained." I think the motive behind this recommendation is that the possibility of transferring a waste disposal problem to an effluent problem, that is, increasing effluent to avoid the waste disposal, should be resisted. Any comments? Ivars.

Mr. GUTMANIS: The general public still believes that there is going to be zero effluents from nuclear activities--major activities. This must be the wrong approach, but, the sensitivity is there. And this goes back to the surprise of some of these goals. There is no statement here which indicates the severity of this particular goal, if it is a goal. Is this really accepted? By whom? It would be accepted eventually, or rejected, but again, the explanation is missing here of the importance of this.

Mr. RODGER: Could I ask Bill a question about this particular goal? It is not the intent, is it, of this goal to negate the considerable body of existing regulation concerning the limitation of releases?

Mr. BISHOP: Not at all. In fact, it is quite consistent with the as-low or reasonably-achievable approach that both our commission and the EPA have adopted in setting such standards.

Mr. MOSS: There might be some discomfort with the use of the word "minimize." It suggests an approach to zero, regardless of--if I could use the word, Ida--the "benefits" of further reduction.

The next goal is, "The responsibility for establishing the waste management program shall not be deferred to future generations or to unknown technologies." Comments?

Mr. GUTMANIS: Here we go again. What do they mean by unknown technology? One technology is known and unknown, I mean, you know, this is an area in which I am quite familiar. Look, the whole damn thing is so unclear here. What is known and what is unknown about technology? I am not asking for Bill to define this thing; he cannot, not to my satisfaction, at least. This is precisely the point I am saying about the entire structure of goals.

Mr. BISHOP: Let me chance it. The goal was aimed at a comment that we received from a number of sources during the course of

our rather intuitive deliberations. That comment was--that the next generation of technologies is going to be able to do better than today's technology. The goal was established to say that we should give the best shot we can today at the waste that exist today with the technologies that we have today, and when better technologies come along, apply them to the next generation of wastes.

Mr. MOSS: Could it be paraphrased: "Let's have on with it?" Yes, Ivars.

Mr. GUTMANIS: Let me go back and be quite specific about this. My problem is very simple, let me go back to Public Law 92-500--the present cost of the Clean Water Act, and implications of that, because it has direct problem with technology as defined. As they defined technology over there with regard to the water abatement techniques, the IRS and some of the states will give you a rebate for any capital expenditures made on those technologies which are explicitly used for waste abatement. They will not make any rebate on those technologies, which, in addition to abatement wastes also increases production and so forth.

As a result of this, almost the entire effort in the abatement area by industry right now is devoted to end-of-the-process abatement. Very little, if anything, has been done about in process change, raw-material change, changes in outputs and products, changes in processes, changes in sub-processes and so forth, because of very silly rulings. CEQ is upset about it; normal people are upset about it; nobody can do anything about it. It has been passed. It has been passed, embodied into 92-500. Here is the same situation. Something you said *...technology which is old and new, no definition is given.* Again, this type of thing just cannot be sloughed off. It cannot be ignored. These things become almost a monument in their own right, eventually.

Mr. MOSS: I really think you have described a different problem, Ivars. You have talked about how right now there is a bias in the laws that encourages investment and add-on pollution control equipment, rather than investment in more integral solutions to the problems that might also change production, and which could do the job more efficiently using known technology.

Mr. GUTMANIS: No, Larry, let me explain. Working at Brookings, we traced this thing back for some time, and the origin of that problem, which exists presently, and it is a large problem, is precisely the wording originally of some of the documents by EPA which explained and try to define the goals, just as this commission is trying to define goals right now.

Mr. SHAREFKIN: I think there is potential confusion, Ivars. What you are talking about is a technology-based standard, whereas this is an omission standard and as far as I understand it, it would

not have any risk incentive effects. It is a different question.

Mr. MOSS: And to get back to something that Walt said, the recommendation, basically, is that we get on with the job now of dealing with the wastes we have and are producing now. Later on we may choose a different method for future ways. Yes, Lois, did you want to say something?

Ms. SHARPE: Simply that it seems to me that I have seldom heard a discussion in which I thought there was more confusion. I think we are confused between what to do with goals, and what must be the criteria later on that will help us to get to these goals. We now bring in regulations. These are all quite different steps in this process.

Mr. MOSS: Right. Let me go on quickly to read another one. "The time period from generation of radioactive wastes and nuclear reactors, other nuclear facilities, or during various activities of the nuclear fuel cycle, to the time of ultimate disposition, shall be minimized." There is a footnote to that pointing out that a need is recognized, a possible need is recognized for cooling of either spent fuel or the waste prior to solidification in shipment. Any comment? I think it is another aspect of getting on with the job.

Mr. VARANINI: Does that mean that surface storage is gone, even if today or tomorrow we find out that reprocessing is suspended for a fairly long period of time?

Mr. MOSS: I think that it is a goal that literally precludes one outcome that is going to be argued later on in a major paper, one that, perhaps, has more detail than these goals. do. Yes, go ahead, Bill.

Mr. BISHOP: Perhaps there is a confusion in the word "minimize." In trying to make our statement succinct we may have succumbed to a danger that the word doesn't necessarily mean to us that we will reduce it irrespective of all other considerations, but in fact that the guiding principle involved will be to reduce it as much as we can, consistent with other considerations.

Mr. ROCHLIN: I guess I would like to lean on that even a little more, Bill. I am bothered by that same word "minimize," and would like to strengthen the idea that there lies within the statements as they are worded here, what to my mind are potential traps for arguing things that I don't think that you meant to argue in your paper. For instance, an argument that, whatever waste disposal method we knew yesterday, we ought to start on tomorrow. The question of minimizing time and minimizing waiting periods--I think the way that these are stated can be used too much to argue that we just ought to get on with it regardless of evaluation.

Mr. MOSS: Yes, I think that this is an area that might require further thought in rewording. Another one is, "To the extent possible, all costs of the waste management system shall be identified and the financial resource assured." Along with this, a comment is made about accepting the general principle that all costs of producing energy shall be internalized. Comment about that?

Mr. ROCHLIN: Does that include the waste management costs which are associated with decommissioning and decontamination of facilities?

Mr. BISHOP: In principle, yes.

Mr. MOSS: The next one is, "The need to handle, treat and dispose of nuclear wastes already in existence shall not dictate the nature of a solution for wastes yet to be generated." Would you like to explain that, Bill?

Mr. BISHOP: Again, in being succinct, our reasoning does not come through necessarily. The point here is that the waste that now exists have had some things done to them. They have been managed in certain ways which may preclude some options for their future management. We would like not to preclude those options for the wastes that are yet to be generated.

Mr. RODGER: As Bill clarified that point, I find no particular problem with it at all. If the argument gets turned around to suggest though that one is facing a vastly different problem in the future than we have in the past, we should bear in mind that the problem which exists is a very significant problem and we must solve it. And I would agree though that we may apply different solutions to that problem than we apply to wastes in the future.

Mr. MOSS: The last goal listed under the short-term aspects of the problem is as follows: "The waste management system shall be designed in such a way that its operation does not depend on the existence of the commercial nuclear power system. Other nuclear fuel cycle operations shall not impose restrictions which limit the flexibility of the waste management system." Any comments?

Mr. ROCHLIN: It isn't really possible to absolutely decouple a fuel cycle from its waste disposal component. There has to be a a transfer across the last interphase.

Mr. BISHOP: Quite true. The goal is addressed really at the question during the shutdown period of the fission episode, but still during the active use of nuclear power, namely, that as the resources provided by the nuclear industry decrease, that should not limit the waste management, nor should the shutdown of the last reactor keep the wastes from the last reactor from being managed, disposed of.

Mr. ROCHLIN: That is quite reasonable, and I must say that didn't come through to me.

Mr. MOSS: There are a few goals listed in this intermediate time period. The first one being, "The organizational and institutional systems shall be designed so as to insure detection and rectification of errors." Comments about that?

The next one is, "As the effects of radioactive waste management are global in nature, the organizational and institutional systems shall take an active part in effecting international waste management agreements and policies."

We have a very cooperative panel that will agree to almost anything at this point, I think. Maybe we will get to a controversial one pretty soon. Another one is, "The organizational implementing systems shall not be self-perpetuating, nor shall they permit waste management technologies to become ends in themselves, unrelated to the needs of society." Of course, if you set up a government agency for this, we have already agreed it would be self-perpetuated. Any comments?

"The organizational implementing system shall not be affected by, nor require changes in the political system, nor reduce the amount of democratic freedom, such as civil liberties." It is hard to argue with some of these.

Mr. RODGER: Well, let's say I fail to follow that one completely. I just literally don't see that any of the things that are proposed or likely to be proposed as a method of handling wastes are going to seriously interfere with civil liberties. I think that whole thing should be removed.

Mr. BISHOP: Once again, Walt, it is not a case that we are implying that the presently proposed solutions would, in fact, violate those goals. I think most of us would agree that everything that is today proposed would, in fact, meet that goal. What we are suggesting with that goal is that some of the implications of the present systems be institutionalized by their mere articulation.

Mr. MOSS: The next one is, "The normal state of the waste management system shall be specified as precisely as possible, so as to maximize the likelihood of recognizing an undesired and/or unexpected event. Institutional mechanisms shall be created that will be responsible for rectifying any errors." Would you like to clarify that, Bill?

Mr. BISHOP: I think the point is that when you specify the normal state of a system, you can look for any deviations from that normal state and, at an early stage, detect a malfunction, and then respond to it.

Mr. MOSS: Okay. The next one is, "Adequate documentation of present activities and decisions to allow future generations that basis for action shall be provided." To a certain extent, this might conflict with Gene Rochlin's social irreversibility goal. Would you like to comment, Gene?

Mr. ROCHLIN: Yes. I wasn't able to read the whole paper, of course, but I have a section in the paper that says that that is not necessarily so, and that what one has to do is construct the documentation and the information system to allow future generations the repair capability with as much care as one constructs the system, so that you don't retain the information without retaining the capability to act on it safely. I don't think that is an impossible goal.

Mr. RODGER: One might suggest that two of the goals get taken care of completely by following through on Dr. Rochlin's analogy. That is, when we finally put the last of it away, then you kill all of the people associated with the organization and then you have accomplished his irreversibility, and eliminated the group.

Mr. MOSS: The next one is, "Budgetary considerations should not provide a determining constraint in the development, operation or error correction of a waste management system."

Mr. BISHOP: There is a point I should emphasize on that. This is directed at the second time period, the time after the use of nuclear power.

Mr. MOSS: Then there is this one, "The intermediate storage and handling of radioactive waste shall be performed in a manner that does not prevent subsequent treatment and handling for ultimate disposition." It is hard to argue with that one, I think.

The next one is, "Retrievability of radioactive wastes with a technical base at least as advanced as present day shall not be precluded." What was in the mind of the task force on that one, Bill?

Mr. BISHOP: I think it is fairly straightforward. It is addressing the sort of question that Gene raised in his point about making the plutonium mine. But, it is also one that we recognize, and I think stated, what we left in because we heard that statement by a number of individuals. It is not something that we, as a task force, uniformly accepted, but we thought it required discussion, so we put it in.

Mr. SHARPE: Does this amount to, in a sense, a form of stockpiling?

Mr. BISHOP: No, the point of the goal is, in fact, to allow further flexibility in the technology in the future, and the possibility

of recovery from errors. But once again, I point out that it was one that we thought was controversial. We heard no conclusive arguments, but we felt it needed further discussion.

Mr. RODGER: As worded, doesn't it literally call for abandoning the idea of a real ultimate disposal and that you have to have a retrievability feature?

Mr. BISHOP: It would eliminate some of the options, Walt. I don't think it would eliminate any of the options that we presently see based on conventional mining techniques, but it might eliminate some of the options like rock melting and such, that have been proposed and are not under current intensive investigation.

Ms. SHARPE: It seems to me that in a system now where the materials program and resource scarcity is being broadly discussed, and in spite of having sold off our past stockpile, stockpiling is again raising to the fore with much mini-legislative proposals and so on, some greater consideration might be given to clarification of this wording.

Mr. MOSS: We are almost at the end of the list and now there are just a few goals on the isolation of the waste from the human environment over the third period, the long period.

Let me just read a couple of them. "The waste management system shall not require stability of social and governmental institutions for its secure and continued operation." Another one is, "The waste management system shall comply with all radiation standards, criteria and regulations established to cover both normal operations and accident situations." And then there is another, "The system shall be capable of meeting the criteria in all conceivable incidences of radiological releases." Any comment?

And finally, there are two last ones. "To avoid the possibility of proliferating radioactive waste sites throughout the country, no nuclear facility shall be licensed that at the end of its operating life, cannot meet decontamination standards, or be dismantled and physically removed from its original site to a waste disposal site."

Mr. BISHOP: I should clarify that with one small comment. It is also possible to call the facility, at the end of its lifetime, a waste disposal site.

Mr. MOSS: But it would have to meet the goals that have been set out for waste disposal sites. And the last one is, "The siting and operation of a waste disposal facility shall be done to avoid as much as possible the foreclosing of future options." I guess future options dealing with the use of the land in that vicinity. Do any of

the panelists want to make some general comments about the goals we have read? I sensed a good deal of agreement with these goals, at least in principle. There may be questions on interpretation of particular words and probably a good deal of uneasiness in the minds of some as to how effective some of these goals can be implemented.

QUESTION AND ANSWER PERIOD

Mr. MOSS: Let's turn then, if there are no more panel comments, to questions and comments from the audience.

I will read first the question from Mr. Mazur, who had his hand up before, which is not precisely on the subject of the discussion we have been having, but questions the structuring of the whole conference. I am not sure that this is the right panel with which to air the issue, since most of you were not involved in the structuring of the conference, but perhaps a few of you would like to comment.

The question is this: "How, quite specifically, does this forum encourage public 'input' in establishing a national nuclear waste management program? In what sense, also, is "an exchange of viewpoints being solicited to assist Federal decision-making in nuclear waste management."

Would anyone wish to comment about that? I think what we hope for is that first, the individuals we have selected to be panelists and authors reflect a spectrum of views. They have, quite obviously, disagreed on a number of issues. To this extent, a degree of public input, or at least a nonestablishment kind of public, has now been engaged in the process of presenting issues to governmental people, who are in the audience, for their consideration. Now, when the planning for this conference took place, one of the problems the planners had was how to more fully involve everyone who wished to be involved in this discussion.

It is not an easy problem to cope with when you have four or five hundred people, how to most effectively engage in a dialogue. And in fact, the dialogue, with the general audience, is circumscribed to a large extent. That was one of the reasons for setting up the workshops, both the ones that were originally scheduled and additional ones, which can be scheduled on an impromptu basis for people who want to discuss particular issues, to get together.

It was also another reason for having some time for questions, during which time we attempt to select a sample of the kinds of

issues and questions that concern members of the audience, for the panel to react to. I don't know if I have answered your question, but that is about the best I can do, I think.

Mr. BISHOP: I would like to also make a brief response on that, and to make just two points. One is that this is just one of many forums in which we are hoping for some sort of input. A point I made yesterday, which may have passed over many, is that I, at least, had some initial reluctance to serve on these panels because my intent of this meeting was to come and listen. So the fact that I am up here is because I have donned another hat, as a member of a task force, which was attached to the governmental planning process. In fact, you will see that the bureaucrats are not on the panel; they are in the audience listening, and that was the intention.

(Question from the audience inaudible.)

Mr. MOSS: The question is, could the purposes of the meeting have been accomplished without anyone else being invited apart from the panelists and the authors and the people from the government agencies?

I don't think so. I think that the discussions we have had with people in the audience, both informally and formally, through these questions and comments, have been valuable, but that is for everyone to judge for himself.

Ms. HOOS: I think there is one thing further to be said. What happens informally is almost as important as what happens formally. I have learned more from corridors and social hours and contacts with people than just the sessions themselves. Earlier in the formation, when we were being given the ground rules, there was an invitation extended that people in the audience, in general, who were interested, should seek out the people they wanted to talk to more. And so, it hasn't been a closed kind of thing. In fact, it has been a good deal more open than many of the workshops and conferences that it has been my tough luck to attend.

Ms. SHARPE: I would add one more thing. As you probably all know now, the organization with which I have long been associated, does encourage the exchange of ideas, between those who have different points of view. I have spent a great deal of my life on trying to arrange conferences that work better, where there was more exchange, where there was a greter freedom of expression and so on and so forth. I would suggest that it is not easy to do. And I would suggest, that if the person who submitted this question, has a plan or a system or ideas about how to do it better--if ERDA is going to go on and have another series of forums of different sorts--this would be a good chance to suggest how they should be run.

Mr. MOSS: We have a number of questions dealing with the fact that the audience has not had the benefit of draft copies of this goals report that we have all been discussing. And I guess, we might first answer the question, and I will ask it of Bill Bishop, if copies of this report can be made available to anyone who wishes to have it. And if they can be made available, how can individuals receive it?

Mr. BISHOP: As a bureaucrat involved in the process of producing some sort of public policy, it is very difficult for me to answer that in a straightforward manner. Let me suggest that the individuals who have that particular interest come see me.

Mr. MOSS: We would all remind you that we have been talking about the need for a very open kind of process, and I am sure that will be given due consideration.

We have a question with respect to the goal of civil liberties. Is this not saying that the goals and implementations be consistent with the Constitution of the United States. What distinction is being made?

Mr. BISHOP: No distinction. He is precisely right.

Mr. MOSS: How can we, the public, feel assured and accept as a "solvable problem" the challenge of successfully isolating the long-lived wastes from the instinctive, investigative probing of man?

Mr. ROCHLIN: I think that that in essence is what I think Gene Varanini and I were talking about--about the role of process. Obviously, if there are people who are discomforted, the process does have to work out. It does have to work out by a definition to the level of public confidence that that is in fact true. Now, I have no way of specifying that. I can specify it to my satisfaction, but probably not to yours.

Mr. BISHOP: I would like to make one quick response to that. The answer, I think, is in principle, to look for the motivations that would cause mankind to go back to some such place. The only one that we identified was the possibility of resources there. I think the immediate answer is, to the best of our ability, identify future resouce potentials of the site areas and avoid places where those resource potentials are high.

Mr. MOSS: Here is a question which probably deals more with implementation than goals, but it has certain goals aspects to it: "The Battelle Lab report states that the 'technology has not been demonstrated' for any waste management alternative except liquid storage, which has a high probability of dispersion. How can you protect the public today, let alone for all times, with undemonstrated technology?"

I assume that we would attempt to demonstrate technology and then see if it met criteria and goals which were established. Would anyone wish to comment?

Mr. VARANINI: There is a very valid point there and it may be one of the reasons that we on the panel are having as much problem as you are in the audience in terms of where we are. And it seems to me, the real reason for that is, the problem hasn't been really set forth. We have sort of talked all around the problem, but we really never did set forth the full nature and extent of the problem. We talked about it; we said it in generalized terms, but we didn't get down to the nitty-gritty of the problem in terms of things like, is NRC going to regulate ERDA? Is ERDA going to declare themselves over and above NRC in terms of demonstration, so the technology advances without certain kinds of assurances? Where does private enterprise come in? What constraints are they under? Who bears the cost as costs are pushed from the use of the resource to its sequestering? I think these are the kinds of problems that are really being asked in that question. And I think that, hopefully, we have muddled around in it a bit, but I think that we probably should have set forth the reason why some action or some major change in action was required. Perhaps some of those things aren't resolvable in the near term.

Mr. MOSS: Here is a question that talks about the relative emphasis given to the short-run versus the long-run problems. He says, "Since our ability to predict consequences and/or probabilities, decreases as time into the future increases (for example, from unknowable climatic, geologic, demographic, cultural, technologic, etc. changes), shouldn't we focus our concern--and hence, our judgmental base for establishing goals, criteria and standards--on minimizing the near-term, relatively confidently predictable, future impacts?" The implicit assumption is thus that adequate near-term management provides the best ability to protect the long-term future. Any comments?

Mr. ROCHLIN: It is certainly true that one ought to select a waste management scheme that minimizes, to the greatest extent, within certain constaints, the exposures to current generations--particularly something which doesn't get talked about too much: occupational hazards to workers in the field. My concern over that in terms of the ranking was simply that, to state that because the future is uncertain, we should always act to minimize present exposure down to the lowest level, regardless of what that ultimate consequence might be is, I think, wrong. I am not saying that there is necessarily a conflict between those, but to the extent that such a conflict is possible, it is my contention that the short-term exposure is the price you pay. And I think there is an acceptance of that in terms of effluent omission, in terms of occupational hazards, and possibly in terms of short-term exposure, that is not trivial.

There are aspects of the nuclear waste problem now, on which these assumptions are implicitly made. Let me make one--which is quite interesting--which is that things are shipped around in containers. The containers do not have zero rads at the surface. They are small, but there is some activity when you ship nuclear waste in a container in a railroad car from point A to point B. There is a possibility of some exposure to some member of the public or some railroad worker at the surface of that cask. It is not a large exposure. I am not saying people are going to get fried, but there is some millirem exposure which is associated with that. And that is a risk you take already as opposed to dropping the waste into a hole underneath the plant, that is, if the plant existed. And I think there are other areas like that. And I am just asking that it be done sort of self-consciously.

Mr. RODGER: Larry, that sort of goes to the comment I tried to make; namely, that we desperately need to divide this problem into two parts, and that, by far, the worst part of the problem doesn't cover such a long period of time that we have to get into these wild uncertainties. The other part of the problem, which is a very different type of problem, is going to last for a very long time, but it should be studied separately from the first one.

Mr. MOSS: Okay. We have a suggestion for an additional workshop. He says, "As a scientist working in nuclear waste management, I would like to hear from 'the public' what they need to and want to know about waste disposal, so that they can make a rational decision on whether or not they would allow a waste repository to be built in their community."

If anyone is interested in following up on that, I suggest that after we adjourn this session, that those people collect, perhaps in this corner of the room and discuss whether you want to have a workshop.

We have a question or a comment: "The discussion by the panel might be summarized as, 'How many curies can dance on the head of a pin?' The obsession for quantification obscures what is necessary and should be undertaken. Is not the issue that the scientific and engineering community believes it can solve any problems of waste management, while the opposition believes that the best way to solve the problem is to kill the technology that generates the waste?" Comment? I guess you have stunned the panel.

Well, I will go on to a question about irreversibility. It is in three parts. The first is, "Why cannot appropriate irreversibility of rad-waste isolation be done by returning radioactive rock to the ground to match the radioactivity of the mined uranium ore?" He even suggests varying the concentration to match nature. Any comment?

Mr. ROCHLIN: Fine.

Mr. SHAREFKIN: I have only seen it discussed in one place. It is in the Union of Concened Scientists' book on the nuclear fuel cycle. It says it is just prohibitive on these cost grounds. I think cost is the reason for excluding it, but without an estimate.

Mr. RODGER: Leaving out the cost all together, I strongly suspect that if we were proposing to do that--and it is not an idea to be dismissed off hand--but if we were proposing to do that, we would be accused of treating it as an effluent, and just throwing it back into the biosphere.

Mr. MOSS: How much additional volume, as compared with the initial volume of mined ore, would be required for such a disposal scheme? Does anyone have an idea?

Mr. RODGER: Yes, there is an EPRI report that does just exactly that, and I tried to find my copy to bring it with me. Maybe Mr. Williams could answer the question. The volume from a ton gets down to 92 liters in high-volume waste, but I forget the size of the cube of the ore that it came from.

(Answer from the audience inaudible.)

Mr. MOSS: The answer was 1.8 million liters as opposed to 91.

Here is a question also on the matter of irreversibility. "In meeting radiation standards, what standards will you choose? How do you know that future standards--in say, 50, 70 or 200 years--might not be much more restrictive, requiring retrievability and reburial? Also, where will standards be utilized--for example, container surface, ground level, site boundary?"

Mr. ROCHLIN: I don't know the answer to the second question. I think that is one of the things that is under development, probably. With regard to the first, there are two things already in Bill's goal statement that address that. One of them is to try to meet the as-low-as-reasonably-achievable standard, which in effect, derived out of a concern that whatever numerical value you set, it might turn out to be thought by people ten years hence as too high. And that is part of the philosophy behind the ALARA.

As for the second part of that question, which is, how do you know? You don't. You can act, I think, in your best conscience and try to make clear to people in future generations that you have done what you could within your knowledge. And, they can curse you and they can kick you and they can beat you, but they can't accuse you of having deliberately shafted them.

Mr. MOSS: Any other comment? Yes, Bill.

Mr. BISHOP: I will try to answer in a generic way the second part of that question, which is that standards are used as the guidepost by which the licensing procedure goes forward, namely, that licenses are either given or rejected on the basis of the analysis of our staff, as to whether their system proposed will meet those standards. So, generically, at least, that is what the standards are used for.

Mr. MOSS: Here is a question on quantification: "A recent study by Cornell University reported in the September 1976 ASHRAE Journal reveals that their research shows previous estimates of health effects caused by routine emissions from the nuclear industry have ignored some of the more important isotopes and inadequate consideration has been given to the persistence of radioactive pollutants. If the nuclear establishment hasn't been able to predict the effects of short-term, low-level radioactivity, how can we rely on them to predict the effects of high-level, long-term radioactivity?

Mr. BISHOP: I would like to say a couple of things about that. There is obviously no answer to the last question--if we can't do the job on low-level, how can we rely on them to predict the effects of high-level--but there are some answers to the first part of the question. There is a petition that is in to the Commission by a northeast group--I can't remember the name--to redo one of our rules on the use of the S-3 Table and the licensing of reactors to take into account these isotopes. That petition is under review by the NRC staff now, and some recommendations will be given to the Commission shortly on what to do about that petition. If the recommendation is to go ahead and grant the petition for rule-making, these questions will be considered in a rule-making proceeding. The question of whether that will take place or not is up to the Commission, of course.

Mr. MOSS: Here are a couple of questions for Bill Bishop dealing with the draft report. "Is it correct that the goals"--as read by myself--"may or may not appear in the report of the task force, or may be reworded before it goes to the commissioners?" I think the answer is yes, isn't that right?

Mr. BISHOP: The answer is yes to both questions. I suspect most of them, in one form or another, will appear in the report that goes into the Commission. Their wording may be changed.

Mr. MOSS: Okay. "In formulating goals for nuclear waste management program and in later fine-tuning these goals into operational objectives, to what extent has the public participated, or to what extent will it participate in the work of the task force? I believe it is not enough to include the public in one goal by saying it will be

included in the decision-making process further downstream, and to leave it at that. There are techniques for public participation--such as, steering committees, workshops, planning balance sheets, and so on..."

Mr. BISHOP: In the operation of our task force, we went to those that we knew of who had expressed some sort of concerns, either through the establishment of program plans, or through publications of one kind or another. We were probably not inclusive of all who had those concerns, but within our purview, we went to those who we knew of. That was our first step at involving the public in finding out what those concerns were from which the goals should flow.

Obviously, in setting the goals, there is only one place that public participation can occur, and that is by saying that it should occur. The mechanisms we did not specify in the goals. That is up to me, I guess, as the NRC leader in this respect, to set out the mechanisms by which it can be done. I would commend to the questioner a document by the Department of Agriculture, on the many techniques that the Forest Service uses. A lot of those are available to us. Plus, of course, the procedures that we have already for rule-making and licensing.

Mr. MOSS: Okay. "To what degree is the development of an allegedly 'acceptable' commercial nuclear waste management program a green light for a massive future commitment to nuclear power development? Is this probable impact of the waste management program being evaluated?"

I will comment briefly about this. I think that there is a belief among some that if they question such things as economic growth in society, or a growing material standard of living, perhaps one that has a significant effect in deteriorating the quality of life as they would see it, that one way of accomplishing the objective of redirecting the course of development is through stopping certain technologies, perhaps nuclear power development. I am not sure this was in the mind of the questioner, but I think that is a strain that is involved in this debate about nuclear power.

To my mind, that kind of strategy is likely to be counterproductive, because it will lead to social divisions and confrontations that will probably not achieve the objectives of the person who wanted the redirection of social goals whereas, another kind of strategy, one in which the full social costs of the different alternatives were estimated and internalized, could very well lead to the same result.

In the case of energy, for example, higher energy prices with fully internalized costs, causing a shift from energy-intensive activities to less energy-intensive activities. It is more likely to happen

that way than to stop certain energy supply technologies, because any attempt to do so, in the long run, I think, would meet with defeat, if some of the underlying reasons for proceeding in the same historical direction of development, we have experienced, are not corrected.

Would other panelists like to comment? This is really getting a bit far afield from this panel. We have some nominations for additional criteria. I am glad about that, maybe you didn't think of everything.

Allen Mazur of Syracuse University asks, "Might you add these to your goals: "One, we stop producing wastes in period A"--that you referred to, Bill--"before society gives up its responsibility to manage them (period B)." Would you like to comment on that? Was that implied by the definition of those periods?

Mr. BISHOP: I think it is automatic in the fact that it is implied, yes.

Mr. MOSS: And then he suggests, "...Reduce existing uncertainties where possible. Consider quantifiable, as well as nonquantifiable values. And protect, not only the public, but also government and industrial people" From the public? "Do all this in a way that is good, wise and safe as opposed to a bad, stupid and dangerous way." Well, are there substantially new criteria not covered by the goals you have suggested?

Mr. BISHOP: I frankly didn't spot them, and if that is a lack in my mental set, then I suggest the questioner come catch me in the corridors and straighten me out.

Mr. MOSS: Also on criteria, a question addressed to Walt Rodger. "Do you concur with the statement that only liquid storage has been demonstrated as a waste management alternative? How do you define 'demonstrated'?"

Mr. RODGER: No, I don't think I would agree that only liquid waste storage has been demonstrated. As a single example, the conversion of liquid waste to, at least, a calcine solid and the storage of that calcine in bins at Idaho has certainly been demonstrated. And there are a number of others.

How would I define "demonstrated"? Of course, that is the horns of the dilemma that the industry finds itself on--when, on the one hand, people are saying that you can't use something that hasn't been demonstrated; and yet you can't demonstrate it without using it. So, we find ourselves in a bit of a problem.

Mr. MOSS: We have several questions dealing with this conflict

between irreversibility and other possible objectives. "Can the panel discuss the apparent conflict between Rochlin's interesting "irreversibility" criteria and what many see as a desirability for, at least, a temporary retrievability option, say, a generation or two?" And--"You imply that high 'technical irreversibility' is desirable. Not so. I believe that the stored energy in nuclear wastes, thermal and radioactive, will be useful and highly desirable for future generations." And then he asks the question, "How do you reconcile 'recoverability' with 'irreversibility'?"

Mr. ROCHLIN: I can dismiss the thermal power of the radioactive wastes immediately as being absolutely trivial.

Mr. MOSS: It is trivial except in very special applications like space power devices and so on.

Mr. ROCHLIN: Yes, that is a different issue. If one is talking about space power, SNAP generators and Pu-238, I would suggest that if the nuclear industry is in place, there will always be plenty of it available from current reactor inventories for any needs you can visualize. The question is, of course, after the nuclear industry ceases to exist at some time in the future, will those materials be valuable? And, essentially, that is what I did attempt to address in that criterion, by making it not an absolute statement, irreversible-reversible, but there are gradations of reversibility. If Pu-238 is valuable for SNAP generators then it is worth something for you to go into the ground and mine it. So, you try to put these in, in a way that you can go in and get them. But, it isn't simple. It is not something that a kid can do with a toy shovel.

Mr. MOSS: "Civil liberties are constitutional. Freedom of choice, upward mobility and freedom to buy all the energy you want are not 'civil' liberties, but are nonetheless important to many people. The goals should (could?) also address the impact of waste management on these 'social' liberties." Comments?

Mr. BISHOP: Again, I would invite the questioner to catch me in the corridor and suggest a way in which that can be done.

Mr. MOSS: But, the goals that were in the draft report and the other ones that were suggested by the panelists, probably would conflict with the social liberties that the questioner asked about.

Mr. BISHOP: That is not intuitively clear.

Mr. MOSS: Well, it depends, I suppose, on--for one thing, the economic cost. I think the implication of the question is, if we spend a lot of money to do these things, we may be depriving society of the use of scarce resources in other fields. But, the trend of

the panel's comments is that economic factors are not really determining in this.

Mr. SHAREFKIN: I would agree with the appended literati, if the activity in question had no effects on anyone else. But, it seems to me that part of the matter is that it does in this generation and other generations. And we have this problem all over in road safety regulation. You can just about make the same objection to having a traffic light at a crossing and that it is depriving me of my liberty to cross when the light is red. It certainly is.

Mr. MOSS: Okay. Here is a question about acceptable levels of risk. "Much of the discussion has been concerned with what system will be used to define the technology which will give us a certain low level of public risk. Much of this is entirely subjective and pointless, unless a level of risk is defined as a point of departure. Would the 'public' accept a risk level equal to that apparently already accepted in use of other energy sources, i.e., the deaths from mining, transportation, pollution, etcetera, from use of coal, estimated to be anywhere from 2,000 to 50,000 a year? If so, current waste disposal technology probably represents overkill rather than inadequacy..." I think this is a point that Mark made before. "...If they choose not to be hypocritical, the public should either let nuclear power proceed, or demand the shutdown of both. How do you reconcile these differences in setting up goals? In other words, are you going to set goals by looking at nuclear power in a vacuum and in comparison to the nonexistent ideal world, or in a real-world comparison to other alternatives in use and apparently tolerated?"

Mr. VARANINI: I think it is a strange paradigm to talk about the public exclusive of the real world. Fortunately or unfortunately, they are the component that makes a large degree of reality in our system without regard to some form of attempted quantification or education to resolve that reality, or to point out that that reality is misperceived. It seems to me, the debates have gone on for years with certain technologists telling them, the public, they have nothing to fear, that we are in a system of overkill, and yet the public keeps reacting. There is a lot of pressure by certain elements in society, and those are the elements that--as one of the other panelists described--are the movers and shakers to some large extent. I find it incredible to try to make a judgment that doesn't involve the ability for input of the public's overriding values within our system.

The other thing is, that deep down inside, maybe the public is right. You know, rather than being arrogant about it, perhaps if the collective intuitivism really isn't something to be just pushed aside, that they have some life experience; they have seen hype jobs before; they have been sold bills of goods on processes, governments, programs and everything else. And perhaps when they view the process as being another hype, that they are right. There really is a possibility

of that. So, it seems to me, you can't say by definition, we will exclude the public or we will say that the public, to the extent it identifies itself as "the public", is ill-informed and will proceed on a quantitative basis without regard. Or you will have a whole other set of decision-makers in fairly short order, under our system, I believe.

Mr. BISHOP: I would like to add just a brief note to what Gene just said. The debate about perceived and real risks ought to be changed somewhat. Rather than "real," we ought to say "perceived" and "calculated" risks, both of which are real.

Mr. SHAREFKIN: Gene, I think you are getting yourself off a real hook with a little populous rhetoric. There is no one "public." There are many very divided publics on some of these questions. And there is a real problem for people who try to look at some of them in some of the terms we discussed. It comes up again and again.

Let me take the example of housing insulation standards, or the publication by the government of the comparative cost of heating a house with and without insulation. That activity is usually justified on the grounds that the information is expensive for people to gather. One could do one of these so-called cost-benefit analyses and justify the function of the government on these grounds. On the other hand, you are changing attitudes in that process and there is an element of paternalism, as there is in our own suppression program. There is an uneasy balance there, Gene.

Ms. SHARPE: We may indeed, in the first answer to that question, have been, according to some people's view, been getting off on a populism kick, but I would point out that the tendency in this country has been to reject the rule by technocrats. We have been through this quite a number of times on issues, and this has been something which the American people seem to have spurned. I would say the only real thing that I can point to in which I think in the way technocrats have made the decision for us, is in the ready adoption of the dominance of the automobile in the American life. This adoption has resulted from a clearly perceived advantage to the public.

In the case of nulear power, when the point comes that a clearly perceived advantage exists, you may, indeed, find that the popular feeling is less against it. We talked a lot yesterday about the lack of confidence that people had and about the necessity for giving a more persuasive explanation. This is one of the reasons that I think it is so important in the goals that were put forth, that a great deal of effort is made to lay out, quite clearly, the uncertainties.

Mr. ROCHLIN: Something that happened early in that statement you read, comes through very clearly, which was: the statement is

subjective and therefore meaningless. I would argue persuasively that subjective is not meaningless; subjective is fraught with meaning. Objective is pretty meaningless, because it is numerical and therefore, not subject to a whole lot of interpretation. Subjective impressions rule people very often and the decisions will be made on that basis.

I want to touch also on the comparison because I think there is a really important point. If people had forward projected the results of scrapping mass transportation systems after the second World War and going so extensively to the automobile, or if they had forecasted when the first coal-burning power stations went in, what the impact of coal mining, fly ash and CO_2 might be, decisions might have been different--or at least the rules and regulations and processes by which those systems then in might have been changed. I don't think it helps to argue that because these things went in, in an unthinking manner, that some new technology which comes along should not be held to a more stringent standard. And I don't think the public believes that either.

Mr. MOSS: I would like to handle a couple of comments very quickly. They deal with what we have been trying to accomplish here in this panel, and I think it gives us an opportunity to clarify that: "This conference cannot be used to assess effectively the validity of the draft NRC document on goals. To attempt to do so is not only to bypass an established review process, but to railroad one view or another down the throats of those members of the public who are here and who have not had an opportunity to review the NRC work." We don't regard this as a forum for putting a stamp of approval on the NRC report. I think we do regard it as an opportunity for some interested people representing a spectrum of views to react to some of the statements in the NRC report, as one step in the long review process that Bill Bishop outlined. Would you like to comment?

Mr. BISHOP: I would like to make just one point. To date, that document is not an NRC document. It is, in fact, a report from a task force which is still in draft form. And so it is not yet subject to the standard, existing review that it will have some time when it becomes an NRC document.

Mr. MOSS: One last question for Gene Varanini. "Mr. Stanbrough's question was not intended to exclude public participation, but rather to ask what risk will they accept? Some will accept a coal equivalent, some apparently will not. He is asking for some positive action by the public to let the technocrats know what risk level is acceptable."

Mr. VARANINI: Yes, in California, in our process, we have a mandated 36 months siting process that basically ends up with the first interaction with the public over a four-month period with 22

public hearings--by the Commission itself, not some deputized circuit rider. And so, I think we have a system where we are listening, and believe me, they have come in. We have an Indian tribe telling us about various problems they have, and a whole variety of other parties, who, I think, collectively, reasonably represent a cross-section of the public.

The other point I would like to make, is: I am not really trying to say that in any sense you should be down on quantitative analysis. It should be just used properly in terms of how overbearing should it be in terms of the final outcome of any process. And it certainly should be used, if for no other reason, to test intuition.

Many times at modeling we will basically break down intuition that seems to be conventional wisdom. So, I wouldn't want to leave the impression that we don't want to do it. I would like to think about quantification in the frame of the best and brightest, where quantification is then used to overwhelm everyone else in the system who has an equally good idea of capability for input. And that is just my point. It is not as dogmatic or as dramatic as it might seem in the abstract, nor is it particularly populous in the pejorative sense of that term.

Mr. MOSS: I think we have had a stimulating discussion. I thank the authors, the panelists, the audience, for their participation and patience. And I look forward to the discussion at the subsequent panels when, I presume, they will address the issues that we failed to resolve. Thank you.

Session was adjourned.

SESSION IV: ORGANIZATIONAL RESPONSIBILITIES AND ALTERNATIVES

MODERATOR: EDMOND ROVNER, LEGISLATIVE DIRECTOR, THE NATIONAL GOVERNORS' CONFERENCE

Presentation of papers by:

MASON WILLRICH, Director, International Relations, Rockefeller Foundation

WILLIAM C. DOUB, Attorney, LeBoeuf, Lamb, Leiby and MacRae

Panel discussion with:

EDWARD HEILMINSKI, Director, Energy Program, The National Governors' Conference

JOHN GRAY, International Energy Associates, Ltd.

ELIZABETH DODSON GRAY, Free-Lance Writer and Ethicist

JOHN ANDELIN, Administrative Assistant, Congressman Mike McCormack of Washington

Mr. ROVNER: The panel consists of six people who have been chosen because we believe that they have six different viewpoints on the question of what kinds of institutions exist, should exist, could exist or should not exist, for the purpose of coping with the problems raised by the waste cycle and the waste problems.

The objective of this section is really to get these six perceptions out on the table, as it were, and then to rely on you in the audience to bring out the nuances, the implications of some of the views that will be presented to you. Consequently, at the conclusion of the presentations of the two major papers and the other four panelists, we will go directly into the questions from the audience.

The first paper is going to be presented by Mason Willrich, who is, by profession, a lawyer, a graduate of Yale University, Phi Beta Kappa, magna cum laude, University of California at Berkeley, where

he got his law degree, admitted to the bars of California, Virginia, and the Supreme Court of the United States. He is regularly on the faculty of the University of Virginia Law School, in Charlottesville, Virginia, from which he is on leave at the moment to serve as the director of International Relations, chairman of Program and Conflict in International Relations of the Rockefeller Foundation.

"Institutional Arrangements for Radioactive Waste Management"

MASON WILLRICH, Director, International Relations, Rockefeller Foundation

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Mr. WILLRICH: Thank you very much, Ed. Post-fission radioactive waste is highly toxic for extremely long periods of time. Whether optimists or pessimists, as we look to the future, we share an expectation that the vital imperatives of military security and energy supply will surely result in the creation of rapidly growing volumes of radioactive waste in the United States. But is it right to continue activities which generate radioactive waste when a safe method for permanent disposition has not been fully demonstrated?

An optimist may deny there is a serious problem because time and money will provide technology for a variety of solutions. A pessimist may deny there is a solution because sometime, somewhere, man-made or natural cataclysms will inevitably breach any technological containment and toxic radioactive waste may then spill or seep into the biosphere.

The risks posed by radioactive waste must be viewed in context and balanced against the benefits to be derived from activities which produce the waste and the consequences if those activities were stopped.

Our security as a nation appears to rest in part on our nuclear deterrent, and the well-being of every society depends on adequate energy. The world urgently needs practical alternatives to fossil energy, and nuclear fission has been demonstrated to be a practical way to generate electricity.

I am currently in the final stages of completing a report to the U.S. Energy Research and Development Admininstration, or ERDA, on radioactive waste management and regulation. The study was done

under the auspices of the Energy Laboratory of the Massachusetts Institute of Technology.

Our report focuses on the management and regulation of post-fission radioactive waste generated in the United States. This includes so-called high-level and transuranic contaminated low-level or TRU waste. The purpose of the report is to assist in developing governmental institutions which are necessary for the safe management of radioactive waste, currently and in the long-term. Indeed, an underlying hope is that our work will accelerate such organizational development within the U.S. government.

Today, I would like to discuss with you our principal conclusions and recommendations, which--I would emphasize--are still tentative.

Let me begin by describing the main features of the current government organization for radioactive waste management and regulation:

The safe management of post-fission radioactive waste is already a present necessity, and an irreversible long-term commitment.

A rapidly growing number of spent fuel assemblies are accumulating in temporary storage pools at commercial nuclear power plants, pending a government decision on whether to authorize reprocessing. If commercial reprocessing is not authorized, the spent fuel must be safely managed indefinitely. A relatively small volume of high-level waste is being stored temporarily in tanks adjacent to a privately owned reprocessing plant that is now shut down. Commercial TRU waste has been disposed of previously in relatively small amounts, at various shallow land burial and ocean dump sites.

However, existing military waste will constitute a much larger and more difficult management problem in the near future than the waste being generated by the commercial nuclear power industry. A large and still growing amount of military high-level waste is being temporarily stored in tanks. No specific plan or schedule for treatment and permanent disposition of this waste has been made public. Rough estimates of the cost of preparing the existing inventory of military high-level waste for safe permanent disposition run as high as $20 billion.

The basic goals of U.S. radioactive waste policy are unclear. The basic technological criteria for permanent disposition of commercial high-level waste are containment and isolation from the biosphere for as long as necessary to prevent it from being or becoming a harmful source of radiation. The basic technological goal regarding TRU waste is undecided, although, if commercial reprocessing is authorized, the quantities of plutonium contained in this category of commercial waste will be comparable to the plutonium quantities in high-level waste.

The technological criteria for military high-level and TRU waste management are unclear. Some critics fear that surface tank storage of already solidified high-level waste will become a permanent disposition of existing volume.

In general, radioactive waste policy contains no explicit criteria to apply in developing institutional arrangements for waste management and regulation. Yet, institutional effectiveness is an essential ingredient of safe management.

The existing organizational structure for radioactive waste management is likely to be unworkable if left unchanged. The management of commercial high-level waste is presently divided between private industry and the Federal government. The private sector is responsible for temporary storage, treatment, packaging and transport, while ERDA is responsible for permanent disposition. Bifurcated responsibility for the series of waste management operations which are technically and functionally integrated creates incentives for each sector to pass through to the other as much as possible of the risks and costs. Moreover, with responsibility divided, underlying tradeoffs between short- and long-term considerations are difficult to make. The existing structure thus tends to prevent, rather than to facilitate, the efficient management of commercial high-level waste.

All management functions for commercial TRU waste have rested with the private sector until now. Proposed Nuclear Regulatory Commission regulations, however, would shift the task of permanent disposition to ERDA. Collection, temporary storage, treatment, packaging and transportation would continue to be managed by the private sector.

ERDA is responsible for all stages in the management of most military high-level and TRU wastes. Most operations are conducted for ERDA by private contractors.

In the case of both commercial and military high-level waste, permanent disposition is authorized only at a Federal repository on Federal land. State land use regulation of the location of permanent repositories for high-level waste is thus ultimately pre-empted by Federal law. Nevertheless, a state government may effective oppose, through political means and legal procedural delays, attempts by the Federal government to establish a Federal repository within its borders, without that state's consent.

The existing framework for radioactive waste regulations, as distinguished from management, is likely to be ineffective if it is left unchanged. In this, NRC has primary comprehensive authority to license commercial high-level and TRU waste operations from temporary storage through permanent disposition. However, NRC has relinquished regulatory authority over TRU waste to certain states. State regulation

has been ineffective in some instances. The Department of Transportation has concurrent regulatory authority with NRC over the transport of radioactive waste.

NRC has authority to license the permanent disposition of military high-level waste, but lacks authority to license the temporary storage and treatment of such waste. NRC has no licensing authority over military TRU waste. Therefore, no independent regulatory agency licenses existing military post-fission radioactive waste to assure the public health and safety. Nevertheless, military high-level and TRU waste constitute the vast bulk of those in existence, and incidents have occurred which have raised doubts about the safety of ERDA's military waste management operations.

Ocean disposal of high-level waste is prohibited by U.S. legislation and international law, and ice sheet disposal in the Antarctic is prohibited by the Antarctic Treaty. The Environmental Protection Agency has concurrent jurisdiction with NRC over ocean dumping of TRU waste, although all such U.S. activity has been suspended.

The Federal scheme of regulations basically pre-empts state safety regulations. State land use regulation may, however, operate to affect the location of all radioactive waste operations, except permanent disposition of high-level waste at a Federal repository. The location of such a repository is a Federal matter which ultimately pre-empts state law. However, as noted above, political and procedural means are available for state opposition.

Pervading the entire framework for radioactive waste regulations are two further features. First, EPA is resonsible for developing generally applicable environmental standards for radiation protection; and second, the National Environmental Policy Act requires a particular procedure, including the preparation of an Environmental Impact Statement, for major Federal actions regarding radioactive waste management and regulations.

A major area of regulatory uncertainty concerns whether NRC has authority to license ERDA demonstrations of methods for permanent disposition of radioactive waste. Such demonstrations, though on a small scale, may be potentially hazardous in themselves. They may also create momentum for rapid expansion into a full scale operation.

With this as background then, what steps should we take to strengthen the capacity of our government institutions to deal effectively with the radioactive waste problem?

Our report recommends consideration of the following institutional reforms in order to deal more effectively with post-fission waste:

First, U.S. radioactive waste policy goals should be clarified to include institutional criteria. Important criteria would be: strong, built-in management incentives; clear differentiation of management regulation, and research and development functions; ample jurisdiction for each functional component to perform all interdependent operations within an area of responsibility; and, finally, adaptability to a changing social environment.

Our second recommendation is that a National Radioactive Waste Authority be established as a Federally-chartered public corporation. The authority would manage all high-level and TRU wastes under U.S. jurisdiction or control.

The Authority would be independent of ERDA. It would be governed by a board of directors composed of members drawn from government, nuclear industry, the academic research community, and the general public. Except for ERDA research, development and demonstration activities, the Authority would own all high-level and TRU waste facilities in the United States. This would include facilities for temporary storage, treatment, and permanent disposition of waste, and any specially constructed waste transport containers. The Authority would take over existing commercial and military waste facilities.

The Authority would be self-financing. It would issue bonds and recover the full cost of providing waste management services from its customers. It would be authorized to conduct waste management operations itself or to contract with private industry for the conduct of such operations.

The Radioactive Waste Authority would thus be intended to provide comprehensive, integrated, efficient management of both commercial and military high-level and TRU waste. It is noteworthy that the Royal Commission on Environmental Pollution has made a comparable recommendation for establishment of a national nuclear waste disposal corporation in Great Britain.

Third, with NRC as the primary agency, a comprehensive regulatory framework should be established to assure the safety of all radioactive waste management operations under U.S. jurisdiction or control. All high-level and TRU waste operations, whether involving commercial or military waste, would be subject to NRC licensing. Licensing would be required of existing, unlicensed military wastes, as well as future commercial and military wastes.

Various categories of waste from diverse sources may be regulated differently in appropriate circumstances, but all regulation would occur within a unified framework headed by NRC. Other interested Federal and state agencies would play advisory roles.

Fourth, ERDA should continue to have primary government

responsibility for research, development, and demonstration of radioactive waste technology. That responsibility would, however, be separated from management of industrial-scale operations on the one hand, and regulation on the other. ERDA-supported radioactive waste research, development, and demonstration activities would be coordinated with and responsive to the needs of both the Nuclear Regulatory Commission and the proposed National Radioactive Waste Authority.

Fifth, the U.S. government should propose that an International Radioactive Waste Commission be established under the International Atomic Energy Agency. International approval would be required for any disposition of high-level or TRU waste which would result in emplacement beyond the limits of national jurisdiction. The IALA Commission would also review and comment on proposals for permanent geologic disposition of high-level or TRU waste within national jurisdictions.

Finally, it is important to consider the problems of transition from the existing situation to what we have proposed. The recommendations are not especially sensitive to future scientific revelations or technological development. While some of them may appear to be quite far-reaching, especially those regarding a new structure for radioactive waste management, it is important to recall that they can be implemented in most instances, with little impact upon large vested interests.

Since research, development, and demonstration would remain ERDA's task, the Radioactive Waste Authority could be launched without any delay in ERDA's plan for radioactive waste demonstration projects. For example, the establishment of an independent Radioactive Waste Authority would be compatible with, and could indeed provide additional impetus for, ERDA demonstration of long-term disposition techniques, and also an early ERDA demonstration of high-level waste solidification at the Allied-General Nuclear Fuel Services facility at Barnwell, South Carolina.

There is today, no long-term management of radioactive waste, no comprehensive scheme for regulation of such waste, and no commercial reprocessing industry in the United States.

I believe that institutions can be developed which will provide reasonable assurances of safe management of radioactive waste in the U.S. and elsewhere in the world. We have an opportunity to do so now, but it may well be our last clear chance.

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Mr. ROVNER. Thank you; our next major paper will be given by Bill Doub. Mr. Doub is a lawyer not only by training but by present

full-time occupation, which distinguishes him from most of us. At the moment, he has both state and Federal experience over a number of administrations. He is a former chairman from a people's council of the Maryland Public Service Commission, a former member of the United States Atomic Energy Commission, the author of a report for the Federal government on organizing for energy, a report that, at the time it was issued, a number of us found quite stimulating but found it hard to find, as a matter of fact; not the most widely distributed report ever prepared by the Federal government. We mailed it out and discovered we were not duplicating anybody else's efforts along these lines. But the report has now come back into serious consideration because of the implications of fractured and fragmented kinds of responsibilities at the Federal level and at the state level.

Mr. Doub is the author of a number of articles. He has spoken widely; he represents a number of business firms in the industry who have not only U.S. interests but have interests abroad, foreign companies that have interests here. It is with a great deal of pleasure that I present Bill Doub.

"Problems of Organizational Structure in the Federal/State System"

WILLIAM O. DOUB, Attorney, DeBoeuf, Lamb, Leiby and MacRae

Mr. DOUB: Thank you, Ed, very much. Good afternoon, ladies and gentlemen.

During the period I have been here and for the past 10 years, it has repeatedly been said, and I guess it will continue to be said, that the management of radioactive waste is one of the most serious generic problems facing the nuclear industry today, and, as such, it poses a distinct challenge to our federal system of government.

I remember just about a year ago, at the time of the Atomic Industrial Forum meeting in Washington, I was asked to speak, and I selected this topic, and I said in substance that the waste constipation within the utility industry, the nuclear industry, both currently and in the future, particularly in the future, could be relieved, in effect, by the laxative of decision making and not more research. And I believe that today.

It is all too evident that this challenge to decision making has

not been met, and, consequently, the problem is worsening to the point that it is threatening the continuation of the industry.

I would like to attempt to examine this problem from an institutional point of view--the interfacing of different levels of government in the management of the place--and to suggest a redefinition of governmental interests to meet that challenge within our existing federal structure of government.

I want to make it very clear at the outset, that I will primarily be discussing Federal-state relationships as they affect low-level waste management, for this is an area where there exists both experience and demonstrated need for rethinking of old solutions.

Low-level nuclear wastes are being generated at a steadily increasing pace, as we know. By the end of 1976, it is currently estimated that there will be over 11 million cubic feet of low-level radioactive waste accumulated by the nuclear power industry--even with plutonium recycle, and a liquid metal fast breeder reactor, and exclusive of decommissioning waste--will average between 330 and 350 cubic feet.

This estimate includes 5.4 million cubic feet of transuranic-contaminated waste. Military waste alone will contribute something in excess of 11 million cubic feet.

Comparisons are odious, but I would remind you that for comparison purposes, the waste produced from the nuclear program will be considerably less than those produced during the same period by coal-fired generating units employing scrubbers. You might want to look at the new book, "Nuclear Power Is Good for Your Health." It has some interesting figures in it and comparisons, if nothing else.

There are a number of reasons that can be given as to why the disposal of radioactive wastes has not received the attention from both the nuclear industry and the government it should have had up until now. There is no existing commercial market for the byproducts of nuclear fission. This must await authorization of the commercial mixed-oxide fuel cycle. Even then, plutonium recycle will create a residue of waste without present commercial value.

There is also a sharp dislocation between the benefits of producing these wastes--i.e., nuclear power generation--and the costs of disposing of them, which makes it difficult to apportion these costs along with the fuel cycle. There has been, therefore, no real economic incentive to settle upon a solution of both the technological and regulatory problems associated with the management of the waste. In the case of the nuclear generating industry, technological solutions immediately translate into dollars saved.

Balanced against historical and even current government and private inertia is increasing public concern about the effects of radioactive wastes on mankind now and in the future. The public, in my judgment, is quite properly concerned about their reversibility decisions regarding the management of waste, and about the ability of political and social institutions to deal with this problem for the centuries currently required. This concern, which to a large degree is fueled by a lack of knowledge, is reflected in proposed moratoria, in-being and proposed rule-making petitions, public interventions, and state legislative activity directed toward restricting or stopping nuclear waste disposal and nuclear power by one means or another.

The regulation of radioactive waste disposal is shared by a multitude of Federal and state agencies, as Mason has mentioned. At the Federal level, there are at least five such agencies which seek to exercise jurisdiction over portions of the problem.

ERDA is responsible for developing an environmentally safe waste management technology and for establishing and managing Federal radioactive waste repositories.

The NRC as an agency, and currently with the 25 Agreement States, regulates the disposal of low-level and transuranic-contaminated waste.

The principal task of the Environmental Protection Agency is the promulgation of general radiation protection standards. In addition, pursuant to the requirements of the National Environmental Policy Act, EPA reviews and comments upon individual and programatic Environmental Impact Statements for nuclear facilities, and advises states on the public health aspects of radioactive materials under the Public Health Service Act of 1970, as amended.

The Marine Protection, Research, and Sanctuaries Act of '72 as amended, the Safe Drinking Water Act of '74 and the Federal Water Pollution Control Act of '72 all grant to EPA additional authority over radioactive materials. EPA will be the permitting authority for ocean disposal of radioactive waste, should that ever occur. As a result of its broad standard-setting authority and its NEPA activities, EPA has the significant impact on the nuclear waste disposal industry, even though it lacks specific regulatory jurisdiction over all but ocean disposal of these materials.

Then we have the U.S. Geological Survey. It advises and assists NRC in assessing the geologic and hydrologic attributes of specific waste storage sites. This involves the actual surveying of sites, such as those operated by Nuclear Engineering Company for low-level (wastes), in Sheffield, Illinois, and Nuclear Fuel Services in West Valley, New York. USGS is also participating in a cooperative program

with the NRC for the development of regulatory criteria pertaining to these physical parameters. If the increasingly active role of USGS in the licensing of nuclear power plants can be taken as a predictive model, one can expect that that agency, if left unchecked, will soon be exercising a standard-setting and quasi regulatory role all its own with respect to radioactive waste disposal facilities.

Regulation of rad-waste disposal, as I mentioned, does not just occur at the Federal level. Under Section 274 of the Atomic Energy Act, individual states may assume regulatory and licensing jurisdiction over by-product, source, and special nuclear material in quantities not sufficient to form a critical mass. As of December 1975, NRC had concluded agreements for cooperation with 25 states. Five of these states license the burial of low level wastes at commercial burial sites. With the exception of Washington and with the addition of Illinois, all of the commercial burial sites are located on state-owned land. The NRC and EPA, among other Federal agencies, supervise state-licensed commercial facilities.

The Federal government, regrettably, has not promulgated a uniform set of criteria with respect to the specific content of these agreements with the states. In 1961, the Atomic Energy Commission approved criteria under which states may assume regulatory control over radioactive materials consistent with the compatibility requirement--that is, compatible with the Federal program of Section 274 of the Act. These criteria are broad, woefully out of date, and offer the states no guidance as to the specific elements of the state regulatory program.

The Atomic Energy Commission, together with the U.S. Public Health Service and the Conference of Radiation Control Program Directors, in cooperation with the Council of State Governments, proposed such criteria in 1974, but they were never formally adopted. The result is a tremendous variety in state requirements with respect to the facilities under discussion here.

Concurrent regulation of low-level radioactive disposal by two levels of government, compounded by a lack of uniformity at the state level, creates obvious procedural problems for the waste disposal industry--and I underline procedural.

There is a wide disparity in regulatory requirements among the several states as well as between the Federal government and the states. The variation in regulatory requirements also means variation in the consideration of health and safety as well as in environmental matters with respect to waste disposal facilities--variations in practice, having little or no relationship to any present or past health or safety problems.

One must also question the ability of the several states to

administer the regulatory effort required here, because of their more limited financial resources, and technical expertise.

Regardless of whether a state has regulatory jurisdiction under Section 274, state and local governments, responsive to the concern and pressures of their constituents, have been attempting to exercise what they consider to be their inherent police powers over the question of whether and how radioactive waste will ultimately be disposed of.

Kansas vetoed the selection of Lyons as a proposed salt bed burial ground for high level radioactive waste. Governor Milliken of Michigan recently demanded assurance from the federal government that Michigan may be able to veto an, site within that state selected by ERDA for similar experiments. Connecticut passed a law this June regulating the transportation of radioactive material shipped from or through the state to a waste disposal site or facility. New York City promulgated amendments to the city health code, in effect prohibiting the transportation of radioactive materials within the city limits.

Suffolk County, New York, is considering similar legislation, as is Cincinnati, Ohio, and New York is debating whether to include radio active materials in the state's more stringent regulations governing hazardous materials. Massachusetts is considering legislation to monitor nuclear installations.

Kentucky has enacted a 10¢ per pound excise tax on the receipt and burial of all radioactive materials and containers coming into Kentucky for burial.

Now let's take this latter example. This example of state activity alone has reduced the monthly quantity of materials received at Nuclear Engineering Company's Maxey Flats waste disposal site from 78,000 cubic feet to 2,000 cubic feet. This tax, by imposing what amounts to a 5000 per cent increase in burial costs, has not only resulted in a severe loss of revenue for the owner of the facility and has virtually closed the site, but paradoxically has also resulted in a loss of revenue for the state--as these wastes are now being shipped to other locales.

Whether this or any of the other attempts of state and local government to enter the fields consistent with the Atomic Energy Act, the Commerce Clause of the Constitution, the Supremacy Clause of the Constitution, the 14th Amendment, or what have you, those issues can be left to another day. But one can be assured that other such instances as I have mentioned will occur in the future, and states will endeavor to exercise control over nuclear waste management.

It should be evident from the foregoing discussion that the federal state interface mechanism in the radioactive waste disposal

area is dysfunctioning. There is a woeful lack of interface among and within the different levels of government.

This in turn has spawned a host of problems for the industry and regulators alike; such as, lack of systematic site selection criteria for future disposal sites, and of uniform standards for determining regulatory issues, a lack of timely and effective licensing by state and Federal regulators; and the failure of either the Federal or state governments to establish perpetual care and maintenance provisions for commercial disposal sites and to assure the adequacy of additional funding provisions to meet such requirements.

The NRC has not, in fact, determined in two years the type of radioactive wastes that can be safely buried and disposed of by shallow burial, with the result that South Carolina, New York, and Kentucky have seized the regulatory initiative and prohibited the commercial burial of transuranic-contaminated waste.

There is a clear stalemate in procedural regulation in this area, and this stalemate, perhaps as much as anything else, is responsible for the lack of public trust in the decision-making process as it affects the nuclear industry.

Perhaps one reason that institutional solutions to this stalemate have not been forthcoming is that the problems involved in a program calling for shared Federal-state regulation are just damned difficult to solve. Radioactive waste disposal presents an area of regulation which requires, on the one hand, the resources, expertise, and uniformity of Federal regulations; but, on the other hand, intimately affects the legitimate concerns of state and local governments.

Therefore, one is presented with a problem requiring accommodation of these interests. Further, any institutional solution will impact upon existing bureaucracies and, in all likelihood, call for a reduction in the scope of power of some of these institutions and organizations. Needless to say, making such a proposal, let alone implementing it, will not be politically popular. A specific problem involved here is that the regulatory solutions fashioned today will affect a substance which will far outlive their passing. This raises institutional challenges such as creating a regulatory system which can be self-perpetuating and dependent of the nuclear industry as we know it today, or even existing social or governmental institutions, as all of these may change.

What is called for is clearly bold, decisive leadership. Finding an institutional solution, therefore, requires first and foremost a realistic evaluation and accommodation of the interests and abilities of the governmental jurisdictions currently competing for control of these facilities. This evaluation has to be conducted vertically;

that is, Federal-state, as well as horizontally--i.e., NRC, ERDA, EPA.

In my opinion, any such evaluation could occasion the following suggestions, and they are just suggestions to make us all think:

One, a reassertion of extensive Federal licensing jurisdiction over the management of low level radioactive waste.

Two, a concomitant reduction in state administrative responsibility with respect to these wastes, and the institutionalization of a meaningful state role, that is state participation in certain defined areas of decision making.

Three, the appointment of the Nuclear Regulatory Commission as lead agency in the regulation of these wastes, including the sole authority to promulgate standards with respect to the method of disposal and maintenance of these low-level wastes, as well as procedures for conducting, operating, safe-guarding, and caring for the facilities.

And, four, both for low and high level wastes the possible utilization of a neutral body of experts to advise on the selection of of geographic areas for the location of these facilities and even perhaps to advise on funding for their perpetual care and maintenance.

It seems clear from the complexity and hazardous nature of the subject being regulated and the concomitant demand for financial and technical resources to deal successfully with the problem, that only the Federal government can provide a system of uniform and effective regulation. The scope of public concern attendant to the disposal of these wastes is no less intense than that involved in the construction and operation of utilization and production facilities, which are currently regulated, in their radiological aspects, exclusively by the Federal government.

Further, low-level waste pose some of the same problems with respect to their disposal, although of a lesser order of severity, as high-level wastes, which have always been regulated at the Federal level.

Although under this proposal, states will lose much of their direct authority to license and regulate low-level waste disposal facilities, this can be compensated for by institutionalizing and thus assuring state participation in decisions to be made at the Federal level.

Since whatever solution is eventually adopted for the geographic distribution of these wastes will occasion locally perceived inequities, it becomes doubly important to assure maximum state participation in the full range of decisions affecting the specific location

of the facility within a given state's borders, as well as the evaluation of the environmental and health and safety aspects of the facilities' construction, operation, and future maintenance. Procedures have got to be designed to accommodate this participation. These could vary from state comments on specific Federal licensing activities to joint hearing boards composed of representatives from both levels of government, at which these issues and other issues of specific concern to the state could be ventilated.

The states could be encouraged to participate through the comment mechanism in the development of site-specific monitoring and surveillance requirements for these facilities, to be implemented at the Federal level. The Council of State Governments could be effective in this regard. States could contribute inspection teams to work along with their Federal equivalents to ensure proper enforcement of Federal regulations.

Maximum state participation in waste management matters will of necessity involve a number of state agencies. Not only should there be consultation with state public health agencies, but also the role of the state public service commissions in waste matters generally has to be taken into account.

At this time, there is very little guidance available to state public service commissions as to the economic and technical considerations involved in the treatment of waste for purposes of utility rate making. As the nation's nuclear program develops, the state public service commissions will have to make important decisions affecting consumer interests in terms of their electric bills.

If the Kentucky burial site should be closed because of the state excise tax, then the additional transportation costs for burying the waste elsewhere will have to be borne by electric consumers. Guidance as to the cost of utilities of handling nuclear waste must be part of any comprehensive Federal regulatory program. Disparity in the treatment of the utility waste management costs by the state public service commission can only result in a variation of the ultimate cost to the consumers of the power produced from nuclear generating plants.

At the Federal level, there is a clear need for one agency to step forward and exercise the full decision-making burden of regulation of nuclear waste. It seems clear to me at the present time that that agency should be the NRC because of its historical expertise with respect to the regulated material. NRC has both the enabling authority and the machinery to adopt the necessary standards and regulations to govern the disposal of all types of nuclear waste. ERDA should retain its R&D function in this area consistent with the philosophy behind the dismantling of the AEC.

There are two discrete issues involved in nulcear waste management

which severely test the capacity of the existing bureaucratic structure in terms of both its public credibility and objectivity. These issues are, of course, the geographic location of waste disposal facilities and the funding of their perpetual care and maintenance. The highly political nature of these issues is a matter of much concern.

One method of achieving important and early decisions on these subjects and with a greater potential for public acceptability would be the creation of a neutral body of experts. This body could be composed of individuals drawn from both public and private life, either in the form of a new Federal advisory body, which need not be a quasi-governmental corporation as Mason suggests, or perhaps even as a separate function of the existing advisory committee on reactor safeguards. Mason's suggestion, I think, is good. I think it is a little extreme. It seems to call for the takeover of all such facilities by the government, be they commercial or government owned.

If a quasi governmental corporation were selected, I would agree with Mason that it should be empowered to issue bonds and finance its activities as well as to fund the perpetual care and maintenance of waste disposal facilities.

The immediate burden of the solution, I think, falls upon the NRC to a large degree. It must act now to reassert its licensing jurisdiction over waste disposal, as well as to grasp the administrative initiative in proposing standards and drafting regulations to govern effectively this most challenging problem.

This does not mean precipitous action; but rather, thoughtful, effective resolution. Thank you.

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Mr. ROVNER: Thank you, Bill.

The first panelist is John E. Gray who currently is the president of the International Energy Associates, Ltd. He is a director of the Atlantic Council, Geomet Explorations, Inc., Institute for Public Transportation of New York. He is the chairman of the Nuclear Fuels Policy Working Group of the Atlantic Council and a member of the Nuclear Energy Subcommittee Council for Economic Development. He is formerly a consultant to the Ford Foundation, MIT Center for Policy Analysis, the National Science Foundation, FEA, Edison Electric Institute, and others. Formerly the president of NUS Corporation, Project Manager of Shippingport Atomic Power Station, he is an engineer by training, having his Bachelor of Science degree in Chemical Engineering from the University of Rhode Island. His credentials would take up

the rest of the afternoon, so I would rather he spoke for himself. Mr. Gray.

Remarks of

JOHN GRAY, International Energy Associates, Ltd.

Mr. GRAY: I was promised that my remarks can be brief and they will be.

I would like to say that the focus of this particular panel is on the institutional arrangements that should be accorded to radioactive waste management. I would begin by saying that the problem is with us, and has been emphasized as so being. We have in place a large amount of waste resultant from the U.S. military program and we have an increasingly large amount of radioactive wastes being generated from the use of nuclear fuels in generating electricity. As I am sure all of you realize, something like 11 per cent of the kilowatt hours used in the United States in this year, 1976, will come from nuclear generation plants. Based on plants being worked and in place, and considering all forms of electric generation, by the year 1985, something close to 30 per cent of the electricity in the United States will come from nuclear generating plants.

So we are not dealing with a hypothetical problem; we are dealing with a problem that is with us today. It won't go away.

What to do about it institutionally? I am attracted to support Mason Willrich's two-pronged attack, one on the completely coherent regulatory approach--i.e., by giving the NRC the authority and responsibility and the lead role, and having the Federal government tackle the problem. I am also compelled to believe that a waste management authority which has the responsibility for putting in place and operating the facilities required to manage radioactive wastes is sound for the reasons that he advances, plus another that we have discussed. That reason is: that while ERDA has the nominal responsibility for the operational management of waste storage facilities, ERDA's role as the U.S. agency responsible for all energy research and development and demonstration is, in my opinion, substantially incompatible with its assuming operational roles for those activities that really derive from the research, development and demonstration.

Some of us had suggested a couple of years ago that it would be very handy to have a clearly delineated responsibility for waste management, outside of ERDA. This came in the context of being on a

group that fairly consistently--in a polite and correct sort of way --beats ERDA over the head with the thought that it is imperative that ERDA get on with the business of developing and demonstrating commercially, waste management in a manner that would allow for acceptance by the body politic that it can be done and is being done.

A very simple and pragmatic thought that evolved was that it would be highly desirable to have in place a properly-constituted government institution that would itself be responsible for getting on with the job of doing the waste management and thus provide added, proper pressure on ERDA to move forward at an accelerated pace on completing the research, development, and commercialization activities that it is chartered to perform.

I don't have much to add to that. I think, however, that the web that Bill Doub weaves as to the existing and developing intricacies and difficulties of Federal-state relations in the regulatory area is in itself a compelling argument in favor of attempting to wrap up the responsibility and assign it singularly to NRC.

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Mr. ROVNER: Our next speaker will be Edward Helminski who is a physicist--opposed to us lawyers--with his degree from the University of Michigan. He is presently employed as the director of the Energy Program of the National Governors' Conference; and previously served as the director of the Office of Science and Technology for the National Conference of State Legislatures, in which capacity he organized and staffed a conference in Nevada, less than two years ago, on the same subject.

Remarks of

EDWARD HELMINSKI, Director, Energy Program, National Governors' Conference

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Mr. HELMINSKI: As a representative of the National Governors' Conference, I have to commend Bill Doub on his views, and I am really sad that he is still not officially a commissioner with the Nuclear Regulatory Commission. That kind of attitude within the Federal government, especially at that level, is what is needed today to establish the kind of institutional decision-making processes that need to be established to deal with nuclear power.

Let me read to you a quote that was made by Governor O'Callaghan in Nevada at our conference about the cooperation of Federal and state governments. Governor O'Callaghan in his presentation regarding the nuclear waste disposal facility in Nevada, said, "The lack of meaningful cooperation between Federal and state governments was indicated by NRC's Waste Storage Proposal. Instead of having participated in the development of that proposal or even having been supplied with detailed information prior to the release of the draft of that statement, Nevada was confronted with a 45-day period within which to evaluate a 600-page proposal that could have had overwhelming emotional and economic impacts on this state. I had 45 days in which to form a committee to review the proposal, to solicit recommendations from that committee, and to evaluate those recommendations and transmit comments. We were given 45 days to develop a document that had taken several years to prepare."

Essentially, that is where Federal-state relations are today with respect to the development of nuclear power itself and in nuclear waste management. What needs to be done, prior to making suggestions for a radioactive waste storage area or any permanent institutional arrangements, is a statement from the President, dealing with the national need to establish a waste management policy--or more so, a radioactive material management policy and organization.

A framework has to be established to involve state and local decision makers in the design of the type of institution that will direct that kind of activity. It is not sufficient to have state and local government policy makers react to a proposal by the agencies or by Congress in terms of legislation for a new agency. State and local policy makers should be involved in the evolution of that type of institution. Then we probably would not be faced with the type of problem that faces us today. The states would not have been co-oped on the decision-making process; they would have part of it, they would have been responsible for it, and they would have been responsible for implementing it.

I would like to take issue with a couple of other things. One is, we are looking at this conference in terms of waste, and I think it is very difficult as you look at the fuel cycle, to separate waste from radioactive materials. When does your waste become a resource in the fuel-reprocessing mechanism?

I think it is pertinent and critical that the United States develop a policy with respect to radioactive material management, and not deal with waste specifically, in the long term.

In the short term, we do have a problem with wastes that are now residing at nuclear power plants. They must be either disposed of or cycled into reprocessing facilities, if that decision is made, so we

have to look in the short term at waste as a problem, military waste as a problem, and handle that situation possibly in an interim disposal fashion, or in a permanent disposal fashion, but the decision has to be made today or start at it.

The design of a decision has to be started today to handle what we have; in the long term, a different solution must be designed and that solution must deal with radioactive material and not waste specifically, because you get yourself into a real problem of distinguishing what material is not waste, what can be useful and what material is waste, if you look at the whole nuclear fuel cycle.

Most of the involvement of state government in the regulatory aspects of nuclear power and nuclear waste management was mentioned by Mr. Doub and it is increasing. I ought to clarify one other thing. There are pieces of legislation occurring today and will continue to occur, that will include a provision that the governor have the veto of the siting of any energy facility or any facility in his state, unless the administrator or the President can prove that the siting of that facility is in the national interest. He will have the burden of proof upon himself, and those kinds of provisions are appearing in legislation. They appeared in the oil shale commercialization act, and they will appear in OCS activity, as the governor's exert their strength on the congressional legislative process.

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Mr. ROVNER: Our next speaker is Elizabeth Dodson Gray. I hesitate to identify her with any organization because in fact, she is here to represent those people who are not represented by organizations.

She was educated at Smith College, with a Bachelor of Divinity from Yale Divinity School in 1954; in 1974, co-authored with her husband, an MIT colleague, a book, "Growth and Its Implications for the Future," which was prepared originally for congressional committee hearing. In 1974 to '76, she was part of the leadership team teaching a seminar at the MIT Sloan School of Management on Strategies for Sustainable Growth. And is presently on the board of Massachusetts Tomorrow. I present, probably, the only non-institutional view that may be heard over the course of these three days. Elizabeth Dodson Gray.

Remarks of

ELIZABETH DODSON GRAY, Free-Lance Writer and Ethicist

Ms. GRAY: I am sure you all noticed from my resume that there is a kind of 20-year lapse in which I disappeared from what was originally a professional life as a religious educator at the college level, into being an Episcopal clergy wife, and mother. And since from what I gathered yesterday and today, I may really be one of the few live, walking around, unaffiliated publics that you all have at this conference, I have asked Ed Rovner for a little extra time, to try to give you some sense of what I feel is the gestalt--the world view, the life space of people like me, and especially women like me. At this point, I will quite unashamedly be representing the Jane Doe's of the world. Not the John Doe's.

Many of you all are male decision makers. So if you will forgive me for a little while, I would like to take you into my world and into my head, so that you can understand that when the decision about nuclear waste or even nuclear power comes at me as an unaffiliated citizen--I should say I am on the Board of Massachusetts Tomorrow--I have put in some of my years as a part of the leg work of the League of Women Voters--basically I am a non-demonstrator, a non-picketer, a kind of woman who has stayed at home and done my thing for many years, despite my graduate and professional background.

I want you to try to understand that when I come to make a decision on some of these matters, it is not made in a vacuum. I had the feeling yesterday from Paul Slovic's paper that the whole business of risk perception was really from what I would perceive as a vacuum --that is not really the world in which I live. I would like to explain to you why, and it involves a little bit of my personal history.

I was married in 1957 and in 1958 became pregnant. Like many other women in my time, I had trouble sleeping and I took sleeping pills, and later discovered that had it not been for the woman at FDA, I could possibly have had a thalidomide baby, because I took those same kinds of pills, but I didn't happen to take thalidomide.

We were in St. Louis at this point, and my child, since I could not nurse her with my own breast, was on milk; and at this time, because of nuclear fallout, the strontium 90 count of the milk that was produced in the St. Louis area was the highest in the whole U.S. So here I was with a child who was beginning to grow her bones with

this marvelous high strontium 90 count. We were advised that we might do better with dry milk so we moved into this, but I kind of held my breath and hoped for the best.

I then had a miscarriage between my first and second child, and I don't remember what medications I was given because I really wasn't concerned about it. I trusted my doctors absolutely. So I had a child who turned out to be a boy, and if you stay with me, then, my children were like five and eight. We were out traveling in California in the summer, camping out, and I came to the horrifying conclusion that there was something wrong with my breast, and that breast cancer was not just something that happened to other people, but God help me, might be happening to me.

I went through a breast biopsy and I was lucky. My cyst or whatever it was, was benign. But it was a very consciousness-raising experience for me as a human being, because I discovered that while my husband and I share almost identical professional consciousnesses or gestalts, suddenly when I passed through the barrier of someone who had come that close to having breast cancer, I suddenly realized that I had moved into another thought world. I knew in my body, that I not only was going to die in a way that my husband didn't apparently really know, but that I could discover tomorrow that I had two or three months to live on breast cancer, or from any other kind of cancer. And that was very interesting to me.

Okay, we go on in my life. We learn about polyvinyl chlorides, and what they do, and we learn about Kepone, and then we learn about DES, and I draw a sigh of relief because whatever it was I took, I produced a female child so I don't have to worry about her having vaginal cancer. Then very recently I have discovered that this is apparently not true and there are effects on boys--and now I have got to go back to my gynecologist and find out if what I took was DES.

I listened to the NBC television documentary narrated by Betty Furness about the 5,500 chemicals in our food. Before I saw this, I had begun to note the this's and the that's about the additives. I started checking the things that I bought, and I had realized that when you talk about Red Dye No. 2, that our favorite summer meal was barbecued chicken made from a prepared barbecue sauce, black cherry Jello--which my son really adored with chunks of pineapple in it--and this was our favorite summer meal and this was no doubt loaded with Red Dye No. 2 for a period of years.

I have worn for 20 years of my life a very reddish-purple lipstick, which I am also now equally sure I have eaten off huge quantities of Red Dye No. 2.

We are up to the NBC documentary. There is a kind of cap on this, when the scientist near the end of the program tells me that

when we are talking about 5,500 compounds mixed together inside your body, we are not talking about something that some people will be vulnerable to, we are talking about combinations of things which most of us will be vulnerable to when you are dealing with that variety of compounds.

Somehow, somewhere along in here, it began to dawn upon me that ...preparing food for my family was a lethal operation. I began going to the store and thinking...my daughter is on a diet...my son has this ...what he likes and doesn't like...I have got my economy needs over here as a clergy wife...and yet shall I so choose what I now understand is in clams...that is killing baby seals...the toxic things in fish...the DES and hormones in beef...what my environmental friends tell me are the hormones in chicken...the additives and all the packages on their shelves--what in God's name do I feed my family every day that probably may not already be poisoning them? Because now, . finally I have gotten it through my head that it takes about 20 years for the cancer effects of this business to show up.

And I find myself looking at my family and myself and my children, and feeling like walking time bombs for the Cancer Society already.

All right, are you still with me? I have two or three friends who die of cancer at my age. Almost all the people I know who are dying are dying of cancer. Somebody must be having heart attacks, according to the statistics, but I don't know people who are having heart attacks; I only know people, grandparents, parents, friends my age--my daughter had a friend who has already died of leukemia, and she has a friend who has a brain tumor.

All right. We are down to my latest batch of friends who have just had their mastectomies because they, being five years older than me, have been taking hormones for their menopause, which I haven't gotten to yet. And I am suddenly very grateful for that flash of intuition in my life which prevented me from taking birth control pills. I had a sense that my hormonal system as a woman was so complicated that that was the only time I didn't think the doctors knew everything. I didn't think they really understood that system, so I never bought into that. But as we learn about that, I have escaped the hormone problems, you know; my friends are having mastectomies.

My daughter, going off to college this year, depending on how she feels about having sex with a variety of people, has birth control options. We now know that the IUD damages, that the birth control pill damages certain percentages, on and on and on. I chose mechanical means with spermicidal jellies and I now contemplate what 20 some years before my husband got a vasectomy did chemically to my vagina--and it is really not pleasant to contemplate.

Then we learn about PCBs in mother's milk and I wonder how I

would feel as a young mother today, if I had been able to nurse my children, looking tenderly down at the picture of this child here nursing on my breast and wondering about the PCB count that was going in.

Now, my friends, this is the world in which I live, when someone says to me, "How do you feel about the nuclear option?" And you have got to understand this because I now understand that I am the first generation, who as one of my friends put it and I quote, "who have pesticide in our fat, asbestos in our lungs and radioactivity, or something, in our bone marrow." And as Betty Furness put it in the documentary, we (meaning people my age) have been guinea pigs for all of these new things that have been discovered and put into our process since after World War II.

What I am talking about, in the general public, is what I feel is the consciousness-raising technique that I think is different than technological optimism or technological pessimism, and I would like to call it a loss of technological fundamentalism.

I came from a Southern Baptist background, so when I say "fundamentalism" I mean the religious attitude that says, "I only have two options. I must believe the Bible absolutely or if I can't believe it absolutely, I am cast adrift upon seas which I personally cannot manage, namely, deciding which passages I will believe and which passages I won't. And therefore, I can only believe in everything or nothing."

I should say I am not a religious fundamentalist. I am capable, apparently, of living emotionally and intellectually with choosing the passages in the Bible that I find relevant and potent, and compelling for my personal decision making. However, reared as a Southern Baptist in a very fundamentalist background--and my mother was a fundamentalist--I am very well acquainted with the feeling about life that says, "It is all or nothing." I must have absolute confidence in this thing or I can't have any confidence at all.

It seems to me that the general public--and myself among them--has had 10-15-20 years ago, a position of marvelous kind of innocence --innocent, technological fundamentalists, in which we honestly felt that all of the experts knew more than we did, knew it all. We knew there were some side effects of the medical drugs that were given us, but we honestly had the confidence that these must be pretty minimal or they wouldn't give it to us, and they would watch them. We had no real sense of what would happen if they were wrong.

I now know--as a person, in my gut--that medical technology and perhaps most technology does not now know everything. And furthermore, when they are wrong, I will live with the consequences. I didn't know that before.

Two weeks ago I had an interesting experience. We revisited the Arch in St. Louis. You know, those of you have been up in the Arch, you start out and all of a sudden this thing begins to lurch, and you have this sense of wanting to regain your balance, and this kind of feeling...every nerve in your body...like when you first flew up in an airplane...kind of wanted to stop it and readjust and do something steady to your universe. And I started correcting my head for this by saying, "Don't worry, they have designed it properly. They know all about it and nothing will happen." And I suddenly realized that this is my traditional assurance to myself to deal with my human feelings of uncertainty as the plane took off, or as this thing lurched --but I didn't believe that anymore when I said it to myself. They know all about it when they designed it, but I suddenly felt...I don't believe that anymore. So I can't feel confident. I kind of quivered all the way up to the Arch, and this is when I realized that I had been a technological fundamentalist, in my non-expert faith; I was cast out in the seas of having to decide, point by point.

Now you scientists, you technologists, do feel confident to make these kinds of decisions that I feel confident as a somewhat trained Biblical scholar to make. But for the rest of us people, particularly when we know that, if my doctor is wrong about my treatment and I die of the consequences, it is not going to really bother him the way it is going to bother me.

Unfortunately, the whole nuclear question as far as I am concerned, what I perceive of the consciousness of the private citizen, is within this kind of gestalt of what the private citizen has learned about the failure of other kinds of technology.

Okay, now if I would for just a minute put on my MIT hat, and what I now know and could phrase it as on the basis of what I feel I have learned, I now realize that what we are dealing with is complex systems. What I know of systems analysis...Reality really is a system. Everything affects everything else, and is composed of all kinds of interacting, natural systems in the biosphere, and interacting social systems.

When we do things which are conceived as well as we can possibly conceive them, I don't think because we have not really understood how complexly interactive reality is, we can really anticipate the effects that we will have--and what I have come to call "delayed effects" because it takes a long time, apparently, for complex systems to have some of the reactions that they will have when you do things within them.

And I now know that all of this cannot be calculated, that we don't know all of this, and that we probably never will, at least for the long foreseeable future.

It seems to me that I can never go back to the kind of unquestioning trust that I had before. While I feel I understand this in terms of complex systems, the average person that I am trying to represent does not understand it or can verbalize in these ways. But I think they feel it in their gut--and this is what you have labeled "loss of confidence in technology."

I have had the feeling that some of you feel quaintly that, if you massaged the public differently, if you brought them into decision making, this would go away. It is not going to. It is like innocence. It is not going to go away, and once you make this realization that no human technology is going to be able to anticipate all of these delayed effects, whether they be social or biological or the interaction of them, you are never going to have such sublime kind of confidence in sailing ahead. And I would assume that the people who have become, over a period of years lately, what you would label as "technological pessimists," this is precisely where they are coming from.

This has made me, for example, a supermarket drop-out. I guess I must be labeled a "passive aggressive." I am not the kind of person who rushes out to the first citizen activist committee, to walk on a picket line about what I now know, and which I feel strongly about.

I have dealt with the situation basically by trying to drop out. I go to my doctor as seldom as possible, I take as few medications as possible. I literally go into my supermarket, buy non-additive bread, take my vegetables and fresh fruits home and scour them to attempt to get the pesticides off. We have become just about vegetarians. We use milk and cheese.

I have come to see that it is no longer in my self-interest to absorb into my body, into my family, many of the products that have been produced by our technological society; it is no longer in my self-interest.

Now when you come at me with a nuclear decision, I think a person like me is only going to be propelled into the picket lines when you want to invade the very precarious private space that I am trying to forge then without moving to Maine or to a desert island, to protect myself from what I begin to see, of very dangerous effects of my society.

And when you begin to invade my space with nuclear plants, people like me will say, "No way. Someplace else, but no way here." Because that is one of the few defenses that I have, because I don't see that I can reach out and change that technological society that I feel very much trapped in and by as a woman.

There is, in some of these papers, this whole business of risk analysis. They say, "Well, there is no technology without risk. And

all these wonderful things that we have given you, and this is the price you must pay." Very frankly, my answer as a woman is, I don't see why that is necessary. You guys, mainly as males, established this technological system, this production system, you created these products, supposedly for me as a beneficiary, and now you tell me that the price of doing that is that statistically many of my numbers ...see, I no longer believe it is a few.

I think when you add up my water pollution and my air pollution, my medical pollution, my cancer ingestion, my this and a million things, my statistics of not being a victim go down to zilcho. I can go up in an airplane with the confidence that one in 10 million flights goes down. And I can trust that. But when I see the multiplicity of carcinogens synergizing in our society and synergizing in my human body as a sink, it is not just the air and the water out there that are sinks of all this--it is my body and my children's body.

I no longer have any confidence that I won't be one of those statistics. Because I was also struck yesterday by the fact, in that whole discussion about risk, no one mentioned the fact that ours is a death-denying society. I am sure you have read about that in all kinds of ways. We can't face the thought of death. We cosmeticize it, we push it aside. Only very recently, and only because in my opinion, so many people are dying of cancer, are we finally beginning to face with books and with all kinds of things, what many of us are going to have to do and do sooner than we might normally; namely, die.

I don't think you can do accurate risk analysis in the society in which the people doing the risk analysis--part of their consciousness is to deny death. And, furthermore, when a part of their consciousness as men in our culture is impinged on by the masculine consciousness which says it is unmasculine to feel fear, to feel that you are vulnerable, the whole schmeer.

Therefore, I see two things in the masculine decision makers' function in our culture which does not give me confidence in their ability to even do accurate risk analysis; namely, they like--we all like--to think we will never die and I think most people do until suddenly something really comes into your life that makes you realize that you really are going to die. Maybe tomorrow. And that is what happened to me. So, two reasons--the death denying and the masculine consciousness--do not give me confidence in the ability of our male decision makers to even accurately assess risk. It seems to me the odds are enormously weighted toward saying, "Yes, these are risks... but we will go ahead, my friends."

All of this gives me the feeling as Betty Furness also said, that I am not a beneficiary of this system. I begin to think that I am a victim.

I think if this becomes a part of your perception, it enormously complicates, if you will, the nuclear issue--because the nuclear issue fits into this. It is not just that we are taking chances with the nuclear, the nuclear is only a part of the things that we are taking chances about.

If you think that my consciousness is the only one that has been affected, I would like to draw your attention to the National Enquirer. I don't know how many of you will read this; it is available in supermarkets. I don't know how many of you guys shop, but I was put onto it because it has the largest circulation of any paper in America. The field that I like to think about intellectually is consciousness, and a male friend of mine said, "Look, you ought to look at this, it has the largest circulation."

If you think I have a thing about cancer, the National Enquirer has the biggest thing about cancer. In their latest issue, there is a headline on the front that says, "Five Top Candy Bars Contain Traces of Chemicals That Cause Cancer." And the headline inside says, "Five Top-Selling Candy Bars Contain Traces of Cancer-Causing Chemicals." They could pose a serious long-range health threat to America's children.

I submit to you that this is where many of us are living, and this is where we come at the whole nuclear thing. Thank you.

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Mr. ROVNER: Thank you. Our final panelist for this part of this afternoon's program is Mr. John Andelin, who is obviously a Californian. He has his degrees from the California Institute of Technology, Stanford. He has served as a member of the technical staff at Hughes Aircraft in Culver City, Malibu. After that was a senior research scientist in cryogenics at the Ford Scientific Laboratory, a research associate in solar physics at Harvard, and since 1971, to the present time, is the administrative assistant to Congressman Mike McCormack who is a member both of the Joint Committee on Atomic Energy and the Committee on Science and Technology. Mr. Andelin.

Remarks of

JOHN ANDELIN, Administrative Assistant, Congressman Mike McCormack of Washington

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Mr. ANDELIN: Thank you. I feel a little ill at ease, coming on after, I think, an impassioned appeal for a more concerned society.

I discovered that I share the majority of those concerns, at some level, and many at the same level. I found that perhaps the only one where I was a little less sure, or in less agreement, was in fact, the nuclear question. I suppose that is because when I look at it from my own background in the days when I was a scientist--if I can claim that after five years in the political world--we have lived with and evolved with, and grown up with radiation, and what a full-blown nuclear industry or no nuclear industry will do, is modify that, to the bulk of the population, by a truly insignificant amount--a fraction of a per cent, something on that nature, and so the effects that will occur from that are almost certainly going to be plus or minus a percent of the effects that already are occurring from that.

The question of the organic pollutants that we have dumped into the atmosphere and the rivers and our food is something quite different. They are new, and I think without any question we don't know what those cumulative effects will be. Our bodies have, by and large, never encountered them.

The only other comment I have relative to that, other than a fairly wholehearted agreement with her, is that those concerns need very much to be expressed at meetings like this, and to be incorporated into the decision making, not of just the nuclear fuel cycle or nuclear waste management, but how we run society and who tells us what they are worried about. Technological justice without social justice, emotional justice, isn't what we want. And so people have to be secure, by and large, with the decisions en masse. And the National Enquirer and a large number of Jane Doe's and a large number of John Doe's under the surface agree with those. We have got to take them into account.

In fact, I guess I would say, by the mere reaction of the audience to a very serious study, of laughter throughout, implies a great deal of personal insecurity about these same issues.

I would like to address some of my own thoughts prior to hearing that, however, and give you just a couple of minutes of discussion. Following from that and the general tone of what I heard today, is that what we are stuck with is a lack of decisions, but we need to make those decisions with uncertainty. We just don't have all the facts.

No action whatsoever is a real decision. If you don't do something or other, the consequences will continue to flow. Time doesn't stop and wait for you. As has been pointed out, we have nuclear wastes in abundance today and we had damned well better do something

with them. What we can see clearly is we have not, in the past, dealt adequately with the problem, at least institutionally. You can't even tell in detail whether we have dealt with it adequately technically, at this stage, because we haven't proceeded to try and test and evaluate and listen to opinions about the options we have. What I see technically looks pretty good to me, but we haven't really addressed it and we haven't explored it thoroughly, and we don't know how many people haven't yet spoken up saying, but look, what about...? This kind of a conference will do something.

I detect a very substantial agreement in general, over the problem. I think we can all nitpick about the details and I certainly would, given that chance. I think that is not the tone that has been set and not the appropriate one for this afternoon. We need decisions and we need a decision methodology as well, and by that what I mean, I think, is clearly expressed by several people before. Not only do you need decisions today, but you want to know what kinds of inputs went into those and what inputs will be important in the future, to modify them in case they weren't the right decisions, or in case we later decide to modify these somehow.

What that means is, if you make clear decisions and you open the decision-making process, then citizens and state governments and industry can proceed to operate with that in mind. They kind of know the ground rules. When you get a new game, you open the box and you read on the cover to find out what the game is you are playing. Very few people sit down and play a game, especially when the stakes are real, and people say, "Don't worry, we will teach you the rules as you go along." A little while later they say, "Well, that applied before, but the rules are a little different in this case."

What we need for all of society is a very open decision-making process.

In the details of what has been discussed, I totally agree that a regulatory process should be made more coherent. I see no reason not to put it in a single institution; NRC is fine by me. Pick a different one--I think the detail structure isn't important. NRC is there; the decisions and the process need to be decided today. I would be very happy to see them much more strongly coordinated.

I think Ed Helminski's comments--make sure you coordinate with the state governments--is also a critical one. Let's go do that. I think the details of the management--while I personally will agree that Mason Willrich's suggestion is a fine one, I am not sure there aren't others. If that is the only one available to me, a yes or no vote, the answer is certainly yes. If I have got some kind of a choice or several months to explore it, which is in fact the reality that this will be explored over the next six months to a year, I would

expect, I would like to hear what the options are before I put my nickel down now. But it is a fine idea, and certainly collecting the waste management authority somehow in some entity, and taking care of its fragmentation--that is critical.

A few other comments I would like to make. I think this meeting is on the order of 10 years late. I am sorry it didn't occur a long time ago and that this isn't a modern version, and that we are not saying, "Wasn't that easy? Now let's look at the really hard problems ...food additives, whatever it might be."

We need decisions. Decisions have to be made by people and I cannot take the organizational structure of the Federal government and put names in the boxes at the moment. I do not know who the President will be, in spite of being an insider. It just isn't quite apparent yet.

I don't know, certainly, which members of Congress will and won't return. I have some modest ideas, but that is not clear. Assuming they return, however, the organizations that are uniquely responsible for what we are talking about here today are the Joint Committee on Atomic Energy. If you are going to reorganize, restructure, the Joint Committee on Atomic Energy may not exist next year. It has been around a long time. There is a large body of interest which says that it has outlived its usefulness. It has been, in various terms, arrogant or careless or something. The House Democratic Caucus has made a formal recommendation that it go away. The House Democratic Study Group, which is a majority of the liberal Democrats in the House, has recommended that the Joint Committee not be abolished, just have its authority stripped. That decision may well be made in early December. That is, prior to the next Congress there will be a Democratic Caucus meeting in early December, and there may not be a Joint Committee. So if you want decisions, it is not clear today. I would like to say, "Well, here is how the decisions might happen." It is not at all clear today who is going to make them or how. I can only tell you why they haven't happened in the past, in the past couple of years at least, because of this lack of interface, because of the way Congress is structured.

I have already cheated. I have used the word "Congress," as if there were such a thing. I was explaining a few weeks ago something about the Congress and I drew a box and I put the word "Congress" in it, and a couple of lines down, I said "House" and "Senate." And I realized I was wrong, and I erased the word "Congress" on the top. It is the House and the Senate. It is the only branch of government where you can have a stand-off. There is one President, there is an odd number of Supreme Court Justices, and there are two Houses and they are totally equal. They explicitly take account of politics, so within each House, there are caucuses and coalitions and whatever names you care to have for vested interest groups that form together

for the moment, to do the next step in some issue. And when you have got 500 members of the House and Senate elected from a small population base, each of which is representing the interests of his people, you can't really expect much in the way of leadership out of that. They can well modify existing proposals in administration, but the Congress cannot lead, that I can see, in any sense.

For example, when I was listening to some of your discussion, the subject came up about the states, individual states not wanting a particular nuclear waste disposal site; and I was thinking to myself of what a typical Congressional solution to that would be. We have recent experience of a solar heating and cooling bill and an electrical vehicle bill, which was a demonstration program, where 5,000 or something or other, mechanical things were put out into the world, and the question was, "Where will they be put?" And the typical Congressional answer was, "We'll divy them up equally per Congressional district."

You are catching on. Given the discussion that perhaps dispersed sites is the proper way of storing nuclear wastes, I can well imagine your Congressional solution being, one per Congressional district. With the proviso that if you can buy off somebody else to take yours, or if you can offer enough to get somebody else's, you can have as many as you want or don't want. That will, in fact, cause a great distribution of wealth, because there are several states and several sites that would love to have them, and I think it would be very difficult to do in some of the districts in New York City, for example.

So, I don't think that is the ideal solution, but if it is left to Congress to lead all by itself that is the kind of a political compromise decision that is most likely to take place. I think what we need, loud and clear, is an overall program, as we have heard, for all of the technological changes that are occurring to society, and I guess I go beyond that.

I was speaking yesterday at a conference on "technology assessment." I told them it is the wrong title for the discipline. It is really a "decision-impact analysis." You make a decision-- or if a time comes when you recognize that a decision could be made, then you really would like to know what is the impact of not doing anything, versus choosing one of these options.

What we really need is to have that laid out very clearly, at least for energy options. When I look at health delivery and social justice and court system, welfare problems, I can't solve those even technically. The energy problems are simple technically. All that is left--which of course is the hard part--is the social and the political problems.

But at least we have taken care of, by and large, the technical ones; with the rest of it, we are a lot worse off. I would love to

see a coherent statement out of any President, wherever it comes out, saying, "Here are the energy problems, here are my proposals, here is what I want done." A clear program--and hand it to the Congress, and something will come out within two years. But if it is not a clear program; it has not been and it appears to be very heavily couched in vested interests--and I don't mean just this most recent administration. As far back as I go, our energy policies have been distinguished by either neglect or what appears to be vested interests.

A clear, concise statement of something that looks honorable to begin with, I think, could wind up a very good energy policy, and I suspect that the nuclear questions and the waste questions would fall out from that in a relatively straightforward way, and I think indications of a conference like this mean that we are beginning to bring in more interests, and we are beginning to address the public policy issues, not just the simple technology. Thank you very much.

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Mr. ROVNER: Thank you, John. As advertised, we will take a five-minute break. When you come back, we will be announcing where the evening sessions will be and what they will be on. Meanwhile, I would like to have whatever cards with questions or comments you want to forward up to us.

Five-Minute Break

QUESTION AND ANSWER PERIOD

Mr. ROVNER: Could we start sitting again? While people are racing to their seats, let me make a couple of announcements.

The ERDA Resource Center will be open until 6:00 this evening, and will open up again at 8:00 tomorrow morning for all the insomniacs who have urgent questions. If you stayed up all night, eat breakfast and be there at 8:00.

There will be three workshops this evening. The first one is on the subject of the NRC Task Force on Goals. There are a number of questions regarding the Task Force Report, and the question of identifying goals is obviously terribly important in articulating concerns regarding waste management. Bill Bishop and several Task Force members will be available, Thursday evening, from 8:30 in Tower Salon 2.

The workshop on International Issues has been changed to Salon 3 and 4.

There will be a workshop on the State's Role in Siting Selection Criteria. Mr. Helminski and I and Mary St. Clair from the Sierra Club, Saginaw interveners, will be there and, I hope, anybody else who is interested. We want to explore the questions of how sites are selected and the roles of various parties, and who is entitled to a voice in it. We will have a brief representation of the current status of federal siting criteria, and then some discussion as to what we think it ought to be. That will be this evening at 8:00 P.M. in Tower Salon 1.

I have the questions, that we have tried to go through. I will try to read those that are really questions rather than comments. In some cases, I am going to have to summarize two or three questions, because they relate to the same issue.

The first question...is a question for Mr. Doub. "Would you explain further your views on state involvement in the management of nuclear materials? What obligations exist for the states and what limitations are there in the states?"

Mr. DOUB: Well, that is a hard question to answer in terms of the role of states. In a consentual democracy such as we live in, decisions have to have support of the public. You can go back in history, as John Andelin mentioned, and look at the failings of the AEC. One of the problems was that the Congress, because of the lack of interest of the public, was willing to delegate the oversight of atomic energy to the Joint Committee. And then if you use Nader's quote, the symbiotic relationship between the Joint Committee and the AEC produced nuclear power, commercial nuclear power, as we know it today.

In point of fact, it wasn't until commercial nuclear reactors began to be built around the country in the middle sixties that the public really became aware of what nuclear power meant.

Now, they have only heard the bad side of it. Mrs. Gray said something to the effect that she is not a technological fundamentalist, and she is going to think about her own self-interest. Well, I don't blame her a bit, but the point is that the public has to be educated. They have got to be given the facts. And therefore, decisions have to be made with public participation for informational purposes. That is one reason.

And that means participation by the states. It is no easy answer to say Federal pre-emption. I noticed that the Department of Transportation just on September 19, came out with a procedure by which conflicting transportation regulations involving a nuclear material

would be resolved...there is a methodology for resolution by the Department.

With regard to whether the state is exceeded in its authority: There has to be accommodation of state interest, because land and water use planning is a historical state prerogative. On the other hand, you can't have a state vetoing or having the right to veto energy projects which are essential for the national welfare. We see this not just in the nuclear power area, but in many other areas. LNG, tankers in the Puget Sound have become a political issue, importation of LNG, what have you.

I think one of the answers to it is that there has to be a coordinative mechanism between the Federal government and the states, which local and national energy objectives and goals are related to the states in terms of objectives. Then the state decision makers can make decisions with some understanding of the implications of those decisions which are in their particular area of authority. You cannot remove the states from the process.

I can give you the more definitive answer of how you could do it in the case of nuclear power waste disposal--with joint hearing boards and independent neutral panels of experts involving state representatives, site selection and all that--but the basic point is that the public has a right to be informed. I will quote John Andelin again--that this Conference is 10 years too late--but in a different sense. This is again an example of the need for informing.

We all can learn. I learned a lot from listening to Mrs. Gray. Certainly nuclear power, where it is today--it is unfortunate that the public's perception of it is so clouded and in many cases, so erroneous.

Mr. HELMINSKI: With respect to the involvement of states, the point has to be made that we are not talking about the state geologists and the association of state radiological experts. We are talking about the governor's office and the legislative offices. Very often our Federal agencies think that if they work with an association of administrators, with the name "state" in front of it, they are working with the governor.

I think ERDA is now paying their dues for that in the State of Michigan. They did not inform the governor's office that they were going to start test drilling, I believe, for geological information in that state with respect to waste disposal.

"States" mean the elected policy people within those states; and when you talk about "local government," you are speaking about the elected officials in those states. They may not get personally involved, once they are informed of what is going on, but they most assuredly have to be informed of what is going on.

Mr. WILLRICH: I would just like to emphasize a point that I think Bill Doub hinted at. The question that was raised here is really a much broader one and much more important one. I think that the question of Federal-state energy relations is one of the key issues in the whole national energy policy mix. It is unresolved, not just with radioactive waste but with energy resource development questions, and with facilities siting questions. It pervades the entire situation.

How to resolve it? I think it has to come as a political matter. It won't come until there is very strong Presidential leadership with a reasonable plan and with state participation in thinking through the consequences of that plan. Until the Federal-state relationship is worked out, so we can make decisions not just with radioactive waste, but in the whole range of resource development and energy intrastructure questions...the United States is going to become increasingly a threat to the security of our allies, and all of the countries in the Middle East, because the way that it is going to be resolved is by increasing oil imports. We are going to look back in another 10 years at the delay that is going on right now, and say that we are indeed the entire world's problem.

Mr. ROVNER: I have a question here for Mr. Willrich and John Gray. Suggestion was made that the ERDA management role is inconsistent with ERDA's R&D function. "Would ERDA's management of Oak Ridge, Fort Smith and Paducah diffusion plants also be inconsistent? How can we avoid the additional delays which would result from additional studies, environmental statements, and so on, which the new management agency would have to undertake?"

Mr. WILLRICH: It might well be a good idea to separate the operation of the enrichment facilities from ERDA. This has been suggested and considered seriously for some time, and in fact one of the analogs for my own thought process in thinking through the radioactive waste authority was the earlier proposal for a government enrichment corporation.

Mr. ROVNER: The second part of that question was, "How can we avoid the additional delays which would result in additional studies, environmental studies, statements, etcetera, which a new management agency would have to undertake?"

Mr. WILLRICH: This is because of where we are at with radioactive waste. We haven't gone through the demonstration step yet, with commercial waste. It is going to take some years to get through that. What we would be doing is, in a sense--as John Gray said--creating a market for radioactive waste management technology. This is somewhat lacking from the present structure, where we have an R&D oriented administration; there is no demand pull for the technology. But there is an R&D organization that is continually concerned about improving the situation.

Mr. GRAY: I think Mason makes the point--the matter of removing responsibility for production of enrichment services from ERDA has been considered and studied and appears to be a rational thing to do if somebody cares to do it. As far as the lost time on the other matters, most of this stuff has been studied to date, and any new work, such as environmental impact statements, have their own time demands anyway, regardless of how it is going to be done, in my opinion.

Mr. ROVNER: I have a question addressed to Mr. Willrich, but I suspect it goes to anybody on the panel as well. "Both this morning and this afternoon, we have heard that any high-level waste management program must be structured to respond to any changes in the social environment, either gradual or abrupt changes. What do you mean by this statement? What changes in social environment could you foresee, predict, or feel now would have to be considered?"

Mr. WILLRICH: I think the author was addressing himself to the point that in any such institution, one of its characteristics would have to be a capacity to adopt to change in conditions, social as well as technological. One cannot predict history forward. And when you are talking about social change, I haven't found it very useful to think about predicting. What it is useful to think about is the fact that there will be change--but not to try to think too hard about what the nature of that change is going to be. To provide enough options within your management structure, however, you are going to go about things so that when there is change, it can be somehow accommodated. John Andelin mentioned this, that one of the things one wants to think about in making decisions is to crank in some inputs that assure flexibility in case you guess wrong.

The thing that impresses me is that we need to get off the mark, the thought that somehow, even if we establish the radioactive waste authority, that that authority is necessarily going to be in existence even in the year 2000. I would expect it would be an unhealthy situation if it were in existence in the form in which it was launched.

Mr. DOUB: I think we have got to recognize that regulation as we know it in this country, is essentially a 20th century device. It is true that the ICC was created in 1887, but it wasn't until the early years of this century that we saw the state public service commissions and the FTC and the FCC and all the other associations come along.

The intention was to regulate the natural monopolies, and then it moved into a new area, and this is what we are struggling with. This is technological regulation. A very recent development. Not just economic regulation. That is, the setting of rates, issuing of permits and granting of tariffs--but also regulating a technology in terms of health and safety of the public.

The problem is how do you make it dynamic so it can react to changed circumstances as regulation should? It is a natural tension point between the regulated entity and the regulator. There are examples that when that tension doesn't exist, that it does not operate in the public interest and loses its purposefulness.

There are constraints on the system, but there are also constraints that make it adaptable to change, and that is what we are talking about. How do we set up a program which can adapt to technological changes, and at the same time, meet the demands for the public as those interests are presently expressed and known?

Mr. ROVNER: There are a number of questions that have come down to the same basic inquiry, "What kinds of management incentives can you visualize for the kind of administration you are suggesting that would be comparable to the incentives that may exist for private industry in their activities?"

Mr. WILLRICH: Money, status, responsibility and ample authority.

Mr. HELMINSKI: I don't think profit can be an incentive with respect to nuclear waste. I have convinced myself that if we concentrate on waste, we are forgetting about tailings and then we are forgetting about the fuel reprocessing industry. I think profit cannot be the motive for private industry getting involved. There are things that can be done to maximize profit and minimize safety. We have seen that over and over again, when private industry has gotten involved in trying to solve the problems that have either been left by technology--solving the problems that really are the bane of mankind. When they are given that responsibility, the profit motive is not enough to have them carry out that responsibility in an effective manner.

Mr. ROVNER: I have got a question here which I think is a sort of hometown question. "In the context of your recommendation that NRC have all regulatory authority over nuclear waste management, in which ways do you recommend that the authorities of EPA be diminished?"

Mr. DOUB: Well, that is a loaded question. I think that Ed Helminski put his finger on it, when he talked about the bad coordination--he used the example in Nevada of Governor O'Callaghan--throughout the regulatory system. One of the things that I have observed is, we are moving to regulations and management by consensus. Everything is put out for comment. Everything is circulated among the interested parties. Now that is not the kind of coordination and leadership that resolves these problems. Coordination and leadership is involving the interest before decisions are made and arrived at, not after the regs are proposed or the decision is made, and then put out--but getting the input early, and then decisively moving ahead. In this whole waste management area, it isn't a technological

problem. There are many technological ways to handle it. It is a leadership problem.

The problem with the fragmentation of authority within the United States government is that--true, the authority was very carefully drawn in terms of the legislation, and, amazingly enough there is little overlap--but one agency can effectively veto an energy project by either acting or not acting.

Going back to regulations of 20th century contrivance, this is the problem--the complexity that has developed within the system within the past 20 or 30 years.

Mr. ROVNER: Let me follow on that with a related question. It says, "Does your reassertion of Federal authority mean rescinding the present agreements of cooperation with the several states that now have them, or renegotiating them?"

Mr. DOUB: I think renegotiating them. When I say the authority should be vested in NRC, I mean NRC should make the decisions with regard to the licensing--that the criteria, standards, regulations, monitoring and all should be commented upon; hearings should be held, enforcement should include state interests in the enforcement process. We have to get the program moving, and somebody has got to have the bit in their mouth, and I think that is NRC. And nothing is happening. We have got to move it. NRC has got to take the bull by the horns.

Mr. ROVNER: I have a question for Elizabeth Gray. "What would it take to persuade you that a nuclear waste disposal policy is adequate. That is, to move you out of the 'nothing stage' of your 'all or nothing' dialectic. More to the point of your gestalt, what symbolic transformation is required for differentiation of the waste disposal problem for the overall problems of nuclear power?"

Mrs. GRAY: Let me break it down and try the first part first. "What would it take to persuade you that a nuclear waste disposal policy is adequate? That is, to move you out of the 'nothing stage' of your 'all or nothing' dialectic?"

I don't really know. I really suspect that we have here a political limit. We may be able to find states that are willing to take a waste disposal plant, but I honestly have the feeling that we are confronting a situation in which many of our citizens are not going to be changed by the information that you all are going to present to them. It may have more to do with the total gestalt that I was trying to tell you about, and not especially just the reaction to the nuclear problem. But I don't see any way that you people can separate the nuclear problem from the general gestalt of the public about their situation.

I don't think it is separable, and I would like to make a comment

here about the whole business of limits. If I put on my MIT hat, Jay Forrester has made what I think is a very shrewd observation, namely that we have solved many of the easy technological problems, and we are now in a situation where we are up against a series of curves: the really hard technological problems, whatever they are, and social and political limits.

One of my observations about male decision makers, is that they tend to say, "These are problems, but damn the torpedoes, full speed ahead! We need leadership; there is a problem, we must solve it." I just would like to say that I don't think some problems are solvable, and I am not referring now to the waste disposal problem. I think we have here a genuine political limit in terms of the reactions of many people to wanting those waste disposal plants. I don't think that is going to go away. I think that is what our luncheon speaker had to say, that we are going to have to confront some of those, not that there are limits that we are going to convert or go around, or reduce or transform, but limits that we are going to have to accommodate to.

I don't know what this says, frankly, about where we are going to put the waste.

Another comment about limits: I find this discussion about organization fascinating, because I hear on the one hand people saying, "We must organize it into one beautiful organized chart and we can localize the authority and know where it is, and it will work." Then I hear other people, sociologists saying, "Ah, but when you get that, you have this set of problems which you all can fill in."

Then there are those who say, "Because of that set of problems, we ought to disperse it into several overlapping things so people can check on one another." As I understand our political system, that was exactly the way our founding fathers went. We set up a political system of checks and balances, because they didn't trust any centralized authority.

But, as we know, when you have several systems, you have fragmentation, things fall down between all the other things that you guys have just articulated. This leads me to the conclusion, logically, that both of these systems stink.

Okay, where does that leave you? It leaves me that we have a genuine organizational problem that is not going to go away, for lots of human reasons that I as a theologian could name to you; namely, that people are fallible and greedy, self-interested, competitive and all kinds of nifty things, in the way we relate to one another. Somehow that doesn't seem to go away when you put them in ERDA or the national government or the state government, or any place else.

We have solved a lot of organizational problems in our day, we have gotten a lot of good things in our society, because the male has had this attitude that a challenge can always be solved. But it is part of my superstructure, intellectually and theologically, at this point, that everything does not fall into that category. There really are some limits upon what human beings are capable of, because we are not gods; we are fallible. I understand much of what you are saying about your organization systems to be, that we need infallible structures; and I don't think that human beings are going to create infallible structures. Now once again, I don't know where this leads us. But I have the quaint feeling that we are peering into some genuine, what I would call, organizational limits and political limits, within which we are going to have to find some solution to our problem. I don't know what they are, because obviously those wastes are still sitting there. But I don't think that some of these limits are going to go away.

Mr. DOUB: I wonder if I could make a comment, because Mrs. Gray fired a shot over my bow. Having served for two years with Dixy Lee Ray, who was chairman of the AEC, I wouldn't dare to respond. But I would say that the Rasmussen report on risk analysis, whether you attack its methodology or the fact that it was performed predominantly by men, you cannot deny the results with regard to what it showed, and that is that nuclear power represents an infinitesimal risk and in comparison with other risks presently accepted by society, the minimal.

Mrs. GRAY: I really would like to respond to that. I would just like to say that that is another example of what I mean, because it may be a very rational study which is convincing to the people who deal rationally with risk analysis, but that does not mean that it has to be or that it will be convincing to the kind of person that I am trying to represent. That person can function strictly on the basis of his or her feeling gestalt when he or she goes to the poll to vote on any of these present options that are given to her. Simply because it is convincing to you as rational decision makers, you think that it is going to be convincing to other people, as you try to pass them and it isn't necessarily going to be. People don't make all their decisions on that basis, they don't have to. There is no law that will say, when they go into vote on nuclear power, they have to take that study seriously. And it is just not going to happen, in my opinion. You might like it to. I don't think it is going to happen.

Mr. ROVNER: I have a question for Ed Helminski. "How do we begin resolving the question of states' rights versus the national good? For example, offshore drilling, western coal, oil shale, tankers, nuclear waste disposal?"

Mr. HELMINSKI: I think the only way I can answer that is to start involving the states--the policymakers; namely, the governors

--in the development of those policies. There are some tradeoffs that get the West makes with the East at times, and I can point to one: the National Governors' Conference this year passed a policy endorsing safety regulation of natural gas. On that committee, we had the endorsement of the State of New York; there were Northeastern states on that committee, in addition to Western states and Northwestern states. There is a recognition by the governors, by state legislatures, that they have to give up something to get something in return.

As far as limits of the energy use, the State of Minnesota has enacted an energy conservation policy that far surpasses anything that is going to come down from the Congress or the President at this stage. There are other states that are looking and spending their dollars on solar energy, without the assistance of the Federal government.

In order to resolve the national good with the states, the states are going to have to be taken into account in determining the national good--that there is at least some channel of communication to the public.

Congress is not a very good channel of communication to the public: it serves the high-pressure lobbyists, whether they are environmental groups or they are highly-paid industrial lobbyists.

State government does have a more direct contact with the people. If it is informed, possibly the public will be better informed. If the capacity of state government is built up to interact effectively as a partner in the Federal decision-making process, possibly the public will be better informed. It is after all, to the benefit of a state legislator or a governor to reflect his immediate constituency's needs. State legislatures are representatives of the people in the state and not Common Cause. If you look at state government in that regard, and they gain some respect at the national level in that regard, we will resolve some of the regional interests of the states.

We do have problems. New Mexico tried to tax the electricity going into Arizona. There are problems with respect to water in the West, and whose water are you going to use to develop all of that shale and coal? The states are beginning to realize that they cannot stand alone, and if they are left to their own means they may force a national energy policy on the country that would probably be reflective of the public.

They do, however, need management capabilities to do this in the Federal government; but the way they design programs, and the way they fund programs as far as states are concerned, indicates that the Federal government is not interested in giving the states the money to establish the capacity to govern.

Mr. ANDELIN: I listened more intently when he complained that Congress isn't the way to or from the people. I think I basically agree with almost everything else that he has said. I guess I would say that there are many ways of access to and from the public at large, and one of them is the press, and "press" I mean in the very generic sense. I consider press to be anyone that somehow is speaking to or writing for more than a few people, and that clearly includes the typical conventional press, teachers and the clergy. And I would like to see a much larger, more widespread dialogue take place in the press from both directions, which doesn't take place now.

Mr. HELMINSKI: I would like to add that we are a federated nation. We are a federal system and it is the states that are the nation, and not the reverse.

Mr. ROVNER: We have focused exclusively up until this point, on the legislative and executive branches of the government. We have a question here that is put to Bill Doub and Mason Willrich. "This discussion about the roles of Federal agencies and the states and the Federal executive branch has ignored the fact that the judicial branch is making, by default, the important decisions, even though they are ill-prepared to do so. Would you agree with this statement?"

Mr. DOUB: Yes, I absolutely agree with it. Some of the expansion of regulatory authority has been a result of judicial interpretation of acts.

I will just give you one personal example. A few months after I was appointed to the AEC, a Federal judge called me up, who just happened to live not too far away; he had an appeal from the Federal Power Commission. He said that now that I worked for the government that he wanted to come over and talk to me about the case. And he didn't quite understand even the buzz-words, the terms used in that particular matter, and we had to talk about that. And he was making a decision which affected the entire nation and involved literally hundreds of millions of dollars. Now the Ash Report on reorganization, suggested that there should be an intermediate court of some sort for appeals from regulatory agencies. That is a concept worth considering.

Mr. WILLRICH: I think that if you look at the role of this judiciary, it really has been into the problem right along. Occasionally it has pushed the regulatory agency into a more expansive regulatory mode, but by and large, the decisions have been telling the agency that it really hasn't done its homework. When a judicial decision comes down that way, if you stand back and look at it from the public viewpoint, it is a pretty glaring kind of situation, of what the agency has in fact done. This is certainly true of the current moratorium that is in effect on nuclear power plants licensing in the United States as a result of the circuit court case.

Although it is much easier to see the glaring deficiencies by hindsight, when you look at what was done from the time that the judge makes his decision , what we are talking about is the judicial branch slowing things down to some extent--but the way to speed up is for the participants in the decision-making process to really do their homework the first time around. To think through the problems themselves--and not constantly expect some sort of broad public participation to do all their homework for them.

Mr. ROVNER: Any of the lawyers around who want to run the risk of being disbarred? A question for Mason Willrich. "Should we have a nuclear fuel cycle corporation, including the whole fuel cycle from enrichment fuel fabrication through waste disposal?"

Mr. WILLRICH: This is certainly an option, one that it seems to be emerging. I think it may come about by what is happening pragmatically in the industry--which is that the one reprocessing plant which is presently built (all built except for the back-end of the reprocessing plant) might well be taken over by the government as the result of the private sector simply throwing in the towel. How long will a joint venture between Allied Chemical and two major oil companies continue losing $15 million a year cash flow? To say nothing of the capital that has been poured into the facility.

So, if that happens, if the government moves in and takes over that plant, you will in fact have nationalized the commercial end of the nuclear fuel cycle business in the United States, for the moment. I don't think that step is necessary. The reason why the waste authority is interesting, is because that is a social cost. There is no social benefit. If we move ahead with commercial reprocessing, and plutonium recycle, it will be because there is benefit from using plutonium and recovered uranium as fuel. So that the private sector, with the profit incentive, can have incentives to do the job.

Mr. ROVNER: This is a question which follows onto what you just said, "Are you passing on only the cost and risk to the Federal government by a corporation that limits itself to the waste disposal?"

Mr. WILLRICH: Let's not talk about nuclear waste, radioactive waste. Let's talk about sewage. How, in point of fact, do we handle, however inadequately--

Mr. ROVNER: We just could say "badly."

Mr. WILLRICH: We handle it badly, but nevertheless in terms of management structure, there is always room for improvement and if we launch the radioactive waste authority, that could be improved from the day it is launched onward. But, the fact of the matter is, just in terms of institutional arrangements, that we set up municipal corporations to manage our sewage, in a metropolitan area, and those

corporations issue bonds. Indeed, they are frequently tax-exempt folks, so our sewage is treated, thanks to the tax breaks for the rich folks. This is a very well-known device for handling waste--a municipal corporation.

Basically, the idea of a Federal authority to handle radioactive waste is simple: here is a particular kind of waste that is particularly dangerous. I won't comment on whether it is any more dangerous than the waste at the local level. It does need national management, but there is nothing unique about the idea of a Federal corporation to manage that kind of waste. We do it all the time at the city level.

Mr. ROVNER: I have a substantial number of cards left. Most of you who have asked these questions have given an identification, so that some of the panelists may want to answer them in writing at their leisure, or they will be around for a fair amount of time and you can ask your questions directly on a one-to-one basis. Some of the cards that came up are really not questions but are comments, which I will of course, give to the people to whom they are addressed.

Let me ask one more question. "Because an agency cannot be truly independent, to what branch, executive or legislative, would your Radioactive Waste Authority be responsible, and what types of accountability have you suggested which would strike the proper balance between political isolation and administrative responsibility, beyond the separation of functions and broad responsibilities, what demands or controls can or should be put on the chief administrator?"

Mr. DOUB: A chief administrator would report to the board of directors, and the board of directors would be responsive to all kinds of constituents, pressures, in other words, the kinds of things that they represented to some extent, on the board. Basically, the entire corporate structure would be subject to the will of Congress. It would have to enact the enabling legislation to get the corporation off the ground. And if you don't like the Congress, you have an opportunity to change it every two years.

Session was adjourned.

SESSION V: ISSUES IN IMPLEMENTATION OF NUCLEAR WASTE MANAGEMENT PROGRAM

MODERATOR: HAROLD P. GREEN, PROFESSOR OF LAW, NATIONAL LAW CENTER, GEORGE WASHINGTON UNIVERSITY

Presentation of papers by:

DEAN E. ABRAHAMSON, School of Public Affairs, University of Minnesota

EUGENE B. SKOLNIKOFF, Director, Center of International Affairs, Massachusetts Institute of Technology

Panel discussion with:

DANIEL CALLAHAN, Director, Institute of Society, Ethics and the Life Sciences, Hastings Center

DAVID J. ROSE, Professor of Nuclear Engineering, Massachusetts Institute of Technology

BARTON Z. COWAN, Attorney, Eckert, Seamans, Cherim and Mellott

ROGER E. KASPERSON, Professor of Government and Geography, Clark University

Mr. GREEN: We're going to be discussing this morning public policy issues in the implementation of nuclear waste management programs. Our first speaker is a man of many parts. Dean Abrahamson holds a Ph.D. degree in anatomy and physics and he is also an M.D. He has had experience as a reactor physicist with Babcock and Wilcox, a senior research scientist at Honeywell. He has been a member of three different faculties at the University of Minnesota: the faculties of medicine, anatomy and physics. And in his second incarnation, he is a member of still a different faculty at the University of Minnesota; he is professor of public affairs.

He has been involved since 1968 in both the United States and the Scandanavian countries in various activities with respect to

nuclear power and other environmental matters. He's a member of the board of trustees of the Natural Resources Defense Council.

It gives me great pleasure to introduce Dr. Dean E. Abrahamson.

"Social, Ethical and Moral Issues in the Implementation of Radioactive Waste Management Objectives"

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Dr. ABRAHAMSON: Thank you, Harold. During the conference, it's been pointed out, and I'm not going to dwell on it further, that containment of the radioactive waste products from this fuel cycle is necessary for a very long time. Others have pointed out that there is no existing program for the management of either the military of the commercial waste. Incidentally, I find it curious that there's even a distinction made because at least from other than the narrow regulatory standpoint, it would seem that the constraints on the management of one should be the same as on the other. Finally, it's been pointed out that there is little, if any, confidence in the industry or its pronouncements over the years.

We have not addressed at this meeting the question, do we need to produce more of these wastes? Depending on how time goes, I may or may not address that. But it certainly is a topic of some interest, and to pretend that it doesn't exist is a little silly. I should also remind those who are going to draft an impact statement that in considering alternatives, this is one that will have to come up.

I'm going to assume, at least for the moment, that more of these wastes are, in fact, going to be produced. Or, on the other hand, we could assume that we have some now--which is certainly the case--and just ask a few questions that have occurred to me and others; questions that I have reason to believe are of interest to the public--at least to that segment of the public that takes an interest in these matters and modifies its behavior accordingly.

The first question: Is it reasonable to strive for complete containment of the radioactive waste?

To date, the management of nuclear waste has included sizable releases to the environment. Some long-live nuclears are routinely released either at reactors or during reprocessing. Other wastes are

being sequestered rather casually; for example, uranium mill tailings, solid waste buried at Maxey Flats and other examples. There have been releases of high-level wastes, for example, at Hanford.

Consider for a moment the prevailing view of waste management, of pollution control, in general. It is regarded as an economic problem. The absolute containment of waste is not regarded as making economic sense.

The pollution control literature has many statements of the various methods to arrive at economic balance between control and releases. For example:

"The correct issue is the optimal degree and type of pollution, the optimal mix of environmental effects, and the optimal degree of personal abuse via work or loss of leisure. The correct problem is that the optimal degree of pollution is not ascertainable, because we do not yet know how to determine the values of relative amounts of pollution and persuade the public to heed these goals."

In addition, there is the dogma of the growing power of technology and the declining importance of the environment. I give two examples from recent economic literature.

The Journal of Economic Literature's 1976 survey of the literature of environmental economics begins with, "Man has probably always worried about his environment because he was once dependent on it."

In a 1974 article, economist Robert Solow assures us that thanks to "the productivity of natural resources increasing more or less exponentially over time, it is expected that the world can, in effect, get along without natural resources."

Unless there's a radical departure from established practice, we can expect decisions regarding the management of radioactive waste to be made in the context of the above remarks. Growth in energy use is imperative, for upon it depends the continued domestic health and national defense. Hence, it must be used; and we simply must not be deterred by inadequacies in waste management.

Economic reality dictates that some "optimal" balance be struck between degree of control and quantity of releases. The balance is a changing one, dependent in large part on the values associated at any given time with infringing upon the productivity of the enterprise in question--in this case, electricity. Also, in this framework, there will be a technical solution--or at least fix--and further, maintaining the health of the biosphere is of decreasing importance.

This set of assumptions is getting us into difficulty with the management of waste in general. It may also be responsible for the

inadequacies of past and current practices in the management of radioactive wastes. What it amounts to is that we have been trading small marginal gains in present welfare for large marginal losses in future welfare from reduced or impaired ecosystem services. Economics cannot demonstrate that such is not the case. Present benefits are measurable and future costs are not.

To be sure, there exists in the economics literature discussions of infinite prices, and also zero discount rates, being used in special circumstances. But I don't know of any example where these have actually been applied in the real world.

How absolute, very long-term containment fits into this backdrop--which includes the dogma that "the correct issue is the optimal degree and type of pollution, the optimal mix of environmental effects"-- remains to be seen. Private expenditures that do not increase private profit are only grudgingly made, regardless of the social necessity of doing so.

It would also be well to remember that under currently accepted regulatory schemes, the absolute quantity of wastes which are released tend to be proportional to the magnitude of the enterprise in question. To be sure, this is being addressed in other cases; but how far can we proceed along these lines with radioactive wastes?

It has been demonstrated in other examples, usually after the activity was well advanced, that other pollutants induce cancers and genetic changes and so forth. But we've known from the outset that the nuclear wastes have these properties.

It may be possible in principle to decide what level of personal abuse we are willing to accept--that is, those of us who are able to take part in the decision--for example, from the risk of cancer; but it is not so easy to decide on an "optimal level" of damage to the genetic pool. There's a lack of moral sensitivity to future, random deaths which are discounted heavily both because of being in the future and because of being random. Present value of kilowatts is not discounted but future deaths are--an ethically questionable situation.

The second point: How about management by "dilute and disperse"? An old and cherished method of waste management is to dilute and disperse. At first glance, it would appear that this practice has been rejected in the case of nuclear waste, but it has not. As has been noted, certain of the wastes are released routinely from the reactors and reprocessing plants.

There will be renewed interest in these routine releases with either attempts to expand the activity, to add new elements to the

activity, with the realization that there's environmental build-up of exposure resulting from even these low releases, or with the possible publication and verification of new research which relates the incidence of malignancies and genetic changes to radiation exposure--and part of that happened last week.

Also, those components of the waste stream which are most persistent and, quite incidentally, the most toxic, are also those which are most suitable for commercial purposes. Many of us remember the whole host of schemes to mine the radioactive wastes to extract the usable materials. Is not using, for example, americium smoke detectors, plutonium-powered cardiac pacemakers, neptunium-powered watches, tritium landing lights, and so forth--there's a long list--is that not just a variant of "dilute and disperse"? Should we be permitting such uses which necessarily involve distributing throughout society a large number of individually small packets of radioactive wastes, particularly when we seem unable to devise acceptable management strategies when the wastes are under relatively tight control?

That's the one aspect of waste management which--nearly as I can tell--hasn't been discussed here. But the literature, the nuclear industry literature, is replete with discussions about commercializing the wastes, turning them into elements of commerce.

Another point: Who is responsible or who will be responsible for the waste? Who can assume the responsibility for assuring--as is being asked, for example, in the initiative efforts--that there's no reasonable chance of radioactivity escaping into the environment through imperfect technology, acts of God, sabotage, or other causes?

At an almost trivial level, compared with the situation which could evolve within a few decades of rapid nuclear proliferation, the current situation with the wastes at the now-abandoned Nuclear Fuel Services plant in New York serves as an example.

The utilities which produce the wastes disavow any responsibility. They had, after all, contracted to have it carted away, reprocessed, and stored. Now this "someone" seems to be rather undefined. It is even claimed--based on an admittedly incomplete record--that nation states themselves do not persist forever, nor do governments. Does this suggest that we must either establish some institution which is likely to persist independent of the stability of nation states or governments or else seek a waste storage strategy which is completely independent of human maintenance and surveillance? And do such exist?

Should the wastes be retrievable or not? If we assume that our social structure persisits unperturbed, then we can probably use engineered surface storage with ease of retrievability. This option, of course, preserves flexibility for a number of things which could develop in years to come. On the other hand, there's a cost with it--

an increased environmental risk and others, too. Deciding on which to choose depends on our assessment not only of technical options but also of future social stability and our responsibility toward future generations.

What legacy should we leave to future generations? Any of the waste management options, except probably shooting the wastes off into the sun--and maybe there, too; I don't know--seems to carry the implication that future generations for a long time to come, if not in perpetuity, must assume the burden of assuring absolute containment. Is this a reasonable legacy?

Where would the wastes be put? There's not exactly a clamor from the public intended to encourage the location of nuclear waste repositories near them. The reaction from Michigan to the announcement that sites there are to be evaluated for their potential as high-level waste repositories is typical.

How will the land use decisions be made? Who will have to assume the risks associated with living in proximity to these wastes? It should be noted that this issue is being raised in other energy-related contexts as well. Nobody seems terribly anxious to live near--or move to accommodate the siting of--power plants, refineries, transmission lines, or a number of other facilities.

Will arriving at the "optimal level of personal abuse" necessitate what would widely be interpreted as coercive measures carried out under Federal authority?

Perhaps coercion is not inevitable. The traditional way to handle a population which is not responsive to the first overtures of moving to accommodate development is to either use the police powers for eminent domain or buy them out. But there's a growing evidence--for example, with the controversies over high-voltage transmission lines--that these approaches are not working.

If coercion and physical displacement to accommodate radioactive waste storage siting are deemed necessary, the logic would be something like: National security demands nuclear power which inevitably produces waste which requires some waste management which must be conducted somewhere and this is the best place so you must be moved.

When one of my social science colleagues read this last week, he pointed out that this is prison logic, that these are prison ethics. And then he asked, "But who are the prisoners?"

A couple of years ago, a Palestinian social scientist came to the University of Minnesota, and he made a number of appearances to discuss his particular interests. During one of these discussions, he drew an interesting--although, of course, speculative--parallel between

his people and people in the United States who would be forcibly removed from their land to make way for energy developments being undertaken to support values which they did not share. I think that is not such a bad parallel after all. In Minnesota people involved with transmission line controversies either are, or about to, take up arms.

Another point: What are the implications of totally engineered systems? Is it necessary to go to a totally engineered system, even in the short run? What are the inherent assumptions about managerial stability, of social stability, or a system which depends on a nuclear "priesthood" or "dedicated cadre" or something equivalent, which is by definition relatively isolated both physically and socially from the rest of society? True, there are precedents--for example, in the military. There are also examples of what may occur--for example, war in Southeast Asia.

Further examples come from the human or social services. We assume across a wide spectrum of problems that our so-called needs will be handled best by those who know better, those who have claimed a particular problem is their domain. The result of this assumption in far too many cases is a sense of confusion, isolation, and impotence on the part of the client.

Clienthood assumes incompetence, dependency, and control. Democracy, on the other hand, requires individuals to understand their problems and behave in their capacity to act in their own behalf. Good clients make bad citizens, and what we desperately need now is good citizens. Some technologies also make bad citizens.

How about this problem of candor? A record of the nuclear industry as well as others--I don't want to single this one out--shows instances when the public has not been kept fully informed. This has been done on a number of levels. Sometimes there's been outright deception and oppression. Sometimes it's been just such things as cosmetizing the language.

I was amused when "hazard analysis" became "safety reports" or whatever they were called. Assemblyman Warren yesterday pointed out that the public is going to be kind of interested when it learns that "core disassembly" means "explode," and that kind of stuff. That's part of it.

There's another level. There have been soothing statements to accompany virtually every environmental release of radioactive materials. There's never a "hazard." There's never a "problem." One wonders why there's regulation at all. You get the notion that they're making popcorn over there at the reprocessing plant or the Hanford waste storage or whatever it is.

At another level during, for example, the Brown's Ferry incident,

the population was not kept informed of what was going on, even though there was a chance that evacuation would be necessary.

There's clearly a problem with reconciling objective reporting of the hazard or potential hazard and the risk of public panic. We recognize that. There's a high tax on telling the truth. But I think that this industry should have learned now in over 10 years that it can't get by any more in not doing so.

Who shall decide and with what information? A central issue in the nuclear power debate is who shall decide. The question applies to not only the broad issue of the acceptability of nuclear power but also to the various considerations of economics of waste management, of control of safeguards and so forth. The decision about adequacy of radioactive waste management and about acceptability of nuclear power which hinges in part on the perception of adequacy of waste management objectives and means proposed to meet these objectives will be made by the public acting through the established political processes. I don't think that anyone questions the right and obligation of the technical community to responsibly address the issues and propose the means. But the public at large will decide on adequacy.

The importance of the adequacy of waste management is widely recognized; for example, many if not all of the proposed initiatives on nuclear power include consideration of waste management. But I know of no example of the public being asked to make a decision on the adequacy of a nuclear waste management option, and it is unlikely that such will ever be the case. Rather, the public has been and will continue to express itself on the broader questions of the acceptability of nuclear power.

To date, the nearest to an uncluttered test of the political acceptability of nuclear power has been in the recent Swedish elections. The party in power prior to the elections advocated major expansion of the nuclear option. Incidentally, that was far from completely uncluttered. That was cluttered in all kinds of ways, but at least to the extent nuclear power played a role in it, it was to abandon or not to abandon--with no mucking around in between, like they've been doing in Montana and California and so forth. The question was put "let's stop it," and that's what I mean by uncluttered.

As it developed, the nuclear issues were--according to the Swedish press and the involved politicians--the decisive issue. Whether or not the promises and claims made during the heat of that campaign can be kept remains to be seen. But people participated through the ballot box.

We may surmise or hope that many of them were guided by their personal evaluation of the social, ethical, and moral implications of

nuclear power. It is unlikely that many of them were able to or were particularly interested in making a "technical" evaluation of the waste management program or of the other technical issues. Their notions of the technical situation were probably based on what they were told by individuals who they had reasons to trust--individuals who themselves were acting as spokesmen for institutions that had a reputation for being reasonably accurate and, above all, being candid about similar or related issues in the past.

The representatives of the nuclear industry and the experts in nuclear technology are, I think, distressed that their assurances about the ease of managing nuclear wastes, and about other things nuclear, are not accepted by a sizable fraction of the voting public.

In a recent discussion on the ethics of energy development, Dr. Robert Seamans said, "Many who are fearful of future radioactive disaster seem to lack confidence in two things: the moral sensitivities of the scientists and engineers who are producing the technologies and the technologies themselves. The anti-nuclear critics sometimes leave the impression that scientists and engineers in the nuclear power industry are godless men."

Implicit in Dr. Seamans comment is the notion that scientists and engineers are themselves resolving nontechnical issues. How else could their "moral sensitivities" even be at issue? Or does competent science and competent engineering depend on the practitioner being morally sensitive--and what would be the implications if the answer were yes?

As to the adequacy of the technology itself, the record is clear that Dr. Seamans is correct. There is a lack of confidence. But the public, and many of the leading nuclear critics upon whose work much of the public concern rests, are neither interested in nor able to make their own evaluation of the adequacy of each of the technologies.

Why is there a lack of confidence in the interpretations offered by the nuclear establishment? Time doesn't permit it, but I think one only has to look at the record. Not only in waste management situations but in other things, comments about economics, comments about availability of uranium, comments about the status of the various technologies. To simply restore confidence in the institutions responsible for nuclear waste is a social concern which must be given high priority.

Also, is there not a point in which moral and ethical issues are involved by overly optimistic or pessimistic public announcements about how things are going?

I believe that it has been decided that the adequacy of nuclear waste management objectives will be decided by the public as part of

the broader question of the acceptability of nuclear power. But we're continuing to see attempts to internalize on the decisions on nuclear power, including waste management, to those who are accustomed to dealing with the technical aspects of the issue. If nuclear power decisions are political, then the perception of the adequacy of the process, and as to the adequacy of current and past industry practices, is important. In many instances, the perception of an issue's significance from a technical standpoint or on the status of a management strategy--whether or not this perception is significantly at variance with what the experts will note to be so--will be the deciding factor. Perhaps some genuine public education should have been included in a plan for implementing radioactive waste management proposals.

I'm not going to talk at all about the option of not producing the wastes. We don't have time.

Considering the waste management implementation questions that I was asked to talk about here today, I was reminded that the first exposure I had to the public policy side of nuclear power involved the management of wastes from a nuclear power station. In early 1968, a few weeks after I began thinking about public policy issues associated with reactors, I was concerned about estimates of the tritium releases to be expected from a boiling-water reactor. There was a discrepancy of several orders of magnitude between "expert" testimony which had been made before the Minnesota Pollution Control Agency, internal reports of a major reactor vendor--people were brown bagging stuff out even then--and computations which I had made.

As it turned out, there is a potential problem with tritium, but in the context of reactor licensing in 1968, it should not have been a significant issue. It was important, however, because the situation had been misrepresented. Because of that, other questions came to be asked, and the public's faith in the adequacy of then-current practices of the management of routine releases of waste was reduced.

Tritium management was important not because of substance but because of process. The only reason that the tritium issue was even raised was because there was evidence that the magnitude of these releases--however large or small, important or unimportant--had been misrepresented.

Could it be the same with the general management of nuclear wastes? Could it be that the process will prove to be more important than the substance. Look at the record.

Over the past decade there have been assurances ad nauseam that there is no problem with the management of these wastes. Isn't it strange that in some cases--for example, during consideration of major accidents--we are admonished to look at the record, but there are no such pleas when waste management is the topic of inquiry?

The record here is different. It contains suppression of the National Academy of Sciences report; Maxey Flats; Hanford; Lyons, Kansas; higher than expected levels being found in oceans and giant sponges--I wonder what that means--; wet holes in New Mexico; leaking drums at Rocky Flats; reprocessing at Morris, Illinois; and so forth and so forth.

It is that the problems are exceedingly difficult? Is it that the nuclear establishment is not really trying to resolve waste issues but has simply responded over the years with a facade of paper? Or is it that our institutions are simply not tuned up to deal with a waste product that's not amenable to the traditional approach?

It is a disgrace that almost 15 years after Oyster Creek we appear to be no further along in the management of radioactive wastes. Even the low-level waste management, probably regarded as the least difficult of all, has, according to a recent issue of the AIF publications, been found to be "shot through with major shortcomings." Our institutions don't seem to want to, or are unable to, deal with the issue. Is the problem with nuclear waste substances or is it partly process? And at this stage of the game, who can we trust to be candid?

To simply restore confidence in the institutions responsible for the management of nuclear waste is a social concern which must be given high priority. But restoring competence must precede the restoration of confidence.

I don't know--it may even be too late--I can't make up my mind. But I've got a sneaking suspicion that the industry and the technical critics have had their day and the jury's out. Maybe that's not right. Maybe the jury isn't quite out yet and we get one more lick at things. I'm not even sure about that. I think that perhaps the political machinery is out there grinding around with the evidence that's available today thinking that 25 years is enough of a time to build one's case. It may be that the time for restoring confidence has past. The opportunity slipped starting in 1968. Maybe not. I don't know.

In closing I just would like to pose to each of you the same question that was presented during a TV debate in the spring of 1976 to then Prime Minister of Sweden Olaf Palme by challenger Thorbjorn Falldin. It applies, I think, to waste management questions as well as to others.

"Mr. Falldin: 'Olaf Palme, can you stand here this evening on this platform and guarantee that you give to the generation of today and the coming generations a better society when you want to give them a nuclear power society? Can you give this guarantee here this evening?' Mr. Palme said nothing."

Thank you.

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Mr. GREEN: Our next speaker will discuss what may very well be the $64 question: How do scientific experts interact with the lay public in implementing nuclear waste management goals?

Professor Eugene B. Skolnikoff was originally educated at MIT in electrical engineering. As a Rhodes scholar, he obtained a Master's degree in politics and economics at Oxford; subsequently a Ph.D. in political science at MIT. He served for a period of five years in both the Eisenhower and Kennedy administrations in the Office of Science and Technology in the White House. He is presently professor of political science and director of the Center of International Studies at MIT. His primary academic interest is in the general question of the relationships between science and government.

It gives me great pleasure to introduce Gene Skolnikoff.

"Interactions Between Scientific Experts and Lay Public in Implementation of Nuclear Waste Management Goals"

EUGENE B. SKOLNIKOFF, Director, Center of International Affairs, Massachusetts Institute of Technology

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Dr. SKOLNIKOFF: Thank you, Harold. I wish I had the $64 answer to that question.

The court opinion that required radioactive waste disposal to be considered in the licensing of reactors gave legal weight to the growing public concern about the management and control of this part of the nuclear fuel cycle. It served to emphasize once again the growing difficulty of dealing with technological issues in our society, issues that raise central questions of decision making, of management, and of regulations.

In fact, the ability to reach decisions about technically complex and necessarily risky issues and to proceed with implementations of those decisions, is becoming one of the central concerns of governance in industrial society. It is not too strong to state that fundamental values of our political system are at stake.

Essential needs of the society must be met, but if decision processes to meet those needs become stalemated, the pressures for more authoritarian modes of government will grow. The preservation of open decision processes that do not lead to stalemate is a difficult task that is likely to get harder, not easier, in the future.

The management of radioactive wastes that we've been discussing these last three days is an excellent example of such a complex and risk-laden issue. It relates to the basic requirement for energy, but also involves long-term questions of safety and control. It is closely tied to issues of national security and raises emotional specters of nuclear danger.

Moreover, it also has the characteristics of issues that are the hardest to deal with: the level of uncertainty is high, the technology is esoteric and not easily accessible, the evaluations of risks are contentious--even among experts--and the opportunity for demagoguery on all sides of the question is, therefore, substantial. Moreover, significant economic and political interests are at stake, further exacerbating the problem of dealing with the issues successfully.

Other papers of this conference have been concerned with analysis of alternative policies for radioactive waste management and some of the questions that are involved. In my paper, I have singled out a few of the considerations of particular relevance and difficulty but they've all been mentioned earlier, and I won't repeat them now. But in attempting to come to grips with these issues in the policy process and to carry out the decisions that are reached, there are a number of observations about technology in the public arena that I believe need to be kept in mind. Let me run down a few.

First, there's no such thing as a riskless technology.

This is obvious, but the subtle characteristics of risk associated with technologies often make acceptance of risk difficult in practice in the political process. The risks associated with technologies already in place are often ignored when new technologies with evident risks are being considered.

The patent risks of a new technology are not easily weighed against the much less certain risks of foregoing the technology. The risks of a new technology are easily seen and may arouse emotional reactions because of their nature rather than their scale--obviously, particularly relevant to nuclear issues.

The new risks may threaten different segments of society than do those of existing technologies. And the risks of new technologies may have different characteristics (for example, individually assumed versus being socially imposed) than those that are already part of everyday life.

Obviously, we are dealing here with comparisons of risks and of benefits associated with those risks. But this is not a wholly quantitative comparison, even if all the information about the technologies and their effects were available. Risk comparisons are partly quantitative, dealing with apparent matters of fact, but are also bound up with emotional, economic, political, and personal aspects that are necessarily subjective.

Second, agreement by experts on the risks associated with the use of specific technologies is not to be expected, even for those aspects that are apparently amenable to quantitative assessments.

It is obvious that if overall risk assessment is subjective, it must involve matters of value as well as of fact, so that no one would expect agreement a priori.

But why is agreement on the quantitative or factual aspects not usually or easily achievable? The problem is simply that policy choices involving new technology are concerned with future actions and thus necessarily involve uncertainty. That means that assessments involving extrapolations of present information--which in itself may be imprecise or in dispute--and, therefore, depend on judgments, analytical competence, and imagination, among other things. All of those not only vary from individual to individual, but are also affected by an individual's attitude or stake in the issue and its broader implication.

The range of disagreement to be expected is not predetermined. It will vary with how much is known, how big a step from the present is being proposed, whether there is agreement on what the issue actually is, and how much testing, experimentation, and study is possible.

A rough consensus among most of the experts is possible if a great deal is known about the technology, the issues are reasonably clear and agreed, the number of relevant professions small, and the nontechnical stakes are not too large. For example, the fluoridation controversy--there was agreement among most of the experts, by comparison with debates over the current issues on nuclear safety. Of course, on new, complex issues, these multitudes of conditions are rarely satisfied.

In general, the more significant the technological step under discussion, which usually correlates with the importance of the issue in social terms, the less likely there is to be agreement by the experts on the definition of the issue and on the technical aspects. Uncertainty can be reduced through research, but it rarely can be removed entirely in advance since in large part that could only be done by actually introducing the technology and observing its effect. Even that is not sufficient where scale or long-term consequences are the basis of important disagreements.

Unfortunately, it is also unlikely that the disagreements among experts will be sharp, amenable to clear exposition. There are likely to be variations in the competence of experts. And the relationship of any important technological issue to broader concerns usually guarantees that different groups will see the questions in different terms.

Third, no one who has become a party to a public policy debate can remain completely disinterested, so that bias or point of view necessarily colors risk assessments.

This is a corollary to the preceding point in that the existence of inextricable value aspects of most issues implies that completely disinterested analyses by experts, or for that matter by any party to an issue, are not possible. Obviously, this is a matter of degree, and is affected by the extent of an individual's involvement and the significance of an issue.

Scientists as well as politicians are not immune. Scientists, too, are likely to be influenced in their professional judgments by their policy preferences. In fact, it is not uncommon to observe scientists and others who use their expertise in an advocacy role consciously or unconciously using information selectively. This does not mean there are no important and useful benefits to be realized by going as far as possible to reach agreement on the technical aspects of an issue; quite the contrary; but the limits must be recognized.

Note that the inevitable existence of bias applies to all parties of interest. Public interest groups are also strongly affected by their goals and their environment as are industry or government representatives. The problem, of course, is not to rule out all analysts as ineligible, but to determine how to proceed recognizing that on important issues most people are interested parties.

Fourth, the participation of the lay public in technological decision making does not guarantee sensible decisions, nor that there is understanding of the issues involved.

Public participation in decisions about technology can have many justifications. The most pragmatic is the public's increasing wariness about the effects of new technology--which we heard quite a bit about in the last two days--and the growing need to allow participation by interested parties in order to reach the decisions that are, in fact, acceptable.

But this objective of greater public participation often founders on lack of responsible attention by the public, or is reflected in plans for unrealistic citizen feedback schemes, or involves groups who do not necessarily reflect the views of those they claim to represent.

Time, attention, interest, and competence to understand the details are often lacking. In factors such as manner of presentation, personality of the protagonists, skepticism of authority, and often widely varying personal objectives--such as concern over employment versus environmental protection--condition the quality of public participation, especially when--as is almost always the case--public exposure time is extremely limited.

Inevitably, therefore, the public, or rather the different publics, must have available formal or informal means to be "represented." If elected representatives are not sufficient representation, and increasingly they are not, other means and institutions are necessary. And the representation must be such that it provides, and is seen as providing, effective participation in the decision process.

Fifth, access to relevant information and analysis is a necessary, though not sufficient, condition for effective participation of interested parties--or their representatives.

When dealing with high technology issues, there is often a natural monopoly of relevant information and competence on the part of government or industry with the greatest stake in proceeding with the technology. At the same time there are usually few individuals outside the immediate protagonists who can digest technical information, reduce it to policy terms, ask the relevant questions, understand the alternatives, and participate meaningfully in policy discussions. The public debates over weapon systems in recent years were only made possible because former government and industry employees with both experience and knowledge elected to enter the list.

The need for information and analysis to be more widely available may be just as difficult to meet in unclassified civilian technology areas even without security problems. It is essential that it be met. It will require conscious measures to make information available and to build a cadre of analysts able to use that information.

It is counterproductive for the protagonists of the technology to assume they are better off if the public at large is ignorant about a technology, leaving decisions to knowledgeable experts. Today's skepticism about the effects of technology coupled with technological ignorance leaves society prey to demagoguery. The absence of trusted, responsible analysts enhances the power of irresponsible analysts, just as the absence of trusted, responsible protagonists of technological systems enhance the power of special interest groups in industry and government.

Disagreement among experts who have been given access to information certainly complicates the problem of reaching decisions, but it is even more dangerous to allow opposition based on fear and ignorance

by withholding information. The challenge is to build a process based on information and knowledge so as to be able to reach acceptable policies even if they are not necessarily optimum from any single point of view.

That injunction leads directly to the final proposition which in many ways is a prerequisite for reaching effective agreement on complex, risky, but needed technological action.

Sixth, the willingness of a society to accept the technological decision that is not fully understood and that carries the risk of unfavorable consequences along with its benefits, even when there has been adequate opportunity for debate and participation, depends fundamentally on the existence of trust and confidence and the essential fairness of that society.

No efforts at public participation, discussion, dissemination of information, or other measures with regard to a complex technology carrying possible risk, will be of much use in achieving willing acceptance unless there's a substantial degree of trust in the system.

In the not too distant past, decisions by experts with little public discussion were relatively easily accepted. Early decisions about nuclear power, many technical military and foreign policy choices, and others in complex technological areas were made with little public debate. The experts had legitimacy. They were trusted to represent all interests on subjects not accessible to the public at large, and it was assumed the issues could be treated largely as technical questions.

But that trust was later seen to be misplaced. Some decisions turned out to be representative only of specific, narrow interests. Others turned out to be made on too narrow a base of knowledge or analysis. And some had serious adverse consequences.

As a result, we are in a new era in which the testimony of experts, especially those in government or industry, is often devalued, challenged, suspect. Yet that, too, must not be allowed to last; for immobility is also a decision and may also have serious consequences.

There must be a middle ground in which there is sufficient openness to explore issues adequately, and sufficient trust to reach closure on a debate and accept a decision even when that applies injury to some parties in interest or more general risk to the society. That can only happen if the process of decision is, and is seen to be, fair --which also means that it represents everyone--or at least those most affected by the decision.

Willingness to share information, to open issues for discussion, to bring in the public early and honestly will contribute to rebuilding

that trust and confidence. But it must be recognized that this is a broader issue that relates to the society as a whole, not just to technological questions. In that sense, the ability to involve the public successfully in decisions on and implementation of policies for nuclear waste management is dependent on deep-seated developments in the general political climate in the United States. There's only a limited influence that the manner of dealing with this particular issue can have on that larger question of trust in the system.

What are the implications of these propositions? Our goal is to be able to reach decisions about a technically complex and necessarily risky issue--radioactive waste management--and to be able to implement those decisions. To what policies and measures when combined with specific issues involved do these propositions point?

It is obvious, first of all, that there is no panacea. In part this is so because, as noted, the ability to deal with this issue is dependent on broader questions of the attitude in the society at large. In part, it is because the technical issues of nuclear waste management cannot be separated in the policy process from the issues associated with nuclear power, such as the need for reprocessing and breeder reactors or from the licensing of reactors themselves now mandated by court decision.

Can they be totally separated from larger social issues such as energy policy, nuclear proliferation, economic growth, inflation, and Middle East politics? In part, it's because there are no shortcuts or assured outcomes of an open policy process.

There are a series of approaches and policies that are relevant to the goal. Let me just try in a few minutes to spell out a few of the more important ones:

One, the open policy discussions that start at early stages.

An obvious, if general, injunction which, however, is not easy to carry out. There's little meaning unless other steps are followed to make information and expertise available outside government and outside the involved industry, which I suggest later.

All deliberations in government cannot be open. That results either in immobility or the development of different forms of internal communication--telephone calls instead of memos, instead of few formal documents, and so forth. Industry, also, has legitimate need for protection of proprietary information in the development of corporate plans. But self-conscious efforts can be made to create opportunities for meaningful public discussions of policy options before decisions are reached. As I said several times, it is important as well that these efforts be seen to be honest, and that they are genuinely held before agencies have decided on their policy choices.

Policies for management of nuclear waste will necessarily be aired in the hearings required for the licensing process for power reactors and the development of Environmental Impact Statements. In fact, it seems likely that waste management will become a major factor in reactor licensing debates--obviously, it already is. But it would be a mistake to think of these hearings as the first step in obtaining public inputs in the decision process. Rather, through a variety of things I will suggest, there should be ample opportunity prior to the hearings to elaborate options, encourage independent analysis, and engage in public discussion.

Two, involvement of other institutions.

The development of analyses and options should be carried out not only inside the government, and with the industry that is directly involved, but also with other institutions in the private sector. This can serve the multiple objectives of making information and analysis more generally available, providing more options from a variety of perspectives for consideration in policy deliberations, and of contributing consensus-building among institutions perceived by the public as having less of a stake in particular policy outcomes and thus, in some sense, serving as their representatives.

Inevitably, if the government sponsors such analyses, it will mean supporting studies carried out by groups that may ultimately turn out to be critics of the policies chosen. If the studies are in fact sponsored before decisions are made, there may be enough reflection of them in the decisions to allow consensus to grow.

In any case, one can hope that competent studies will serve to make disagreements clearer and more easily debated. Since disagreements and varying assessments are unavoidable, any steps that sharpen the real issues under dispute are likely to reduce confusion and make ultimate choices much easier.

The need for widespread involvement means that on important issues it would be wise to commission studies by more than one outside institution. There's nothing wrong and much to be gained by seeking analyses on the same issues from multiple sources.

Government support for analytical studies also carries some obvious dangers. Over time, it may influence the attitudes of those who become dependent on continuing funding and thus that practice can become a way of co-opting potential critics. Providing for diversity of sources for funds from various parts of the government can help to alleviate that danger; better yet are analyses that are wholly supported from private sources.

Three, outside reviews of major policy analysis.

When a government agency commissions a major study it intends to use as a basis for policy decisions, it should also fund outside reviews of that study to develop comments and to highlight issues. The Rasmussen study is an interesting example in the sense that the critics were given some time to comment on the study before it was put in final form, but were expected to find the resources to do that entirely from their own sources. And one of the effects of that is there has been growing criticism--which is probably now being given greater emphasis than it ought to be--simply because it was not included in the deliberations of the report itself.

Four, public forums.

Public forums presumably such as this one held frequently or on a continuing basis can provide occasions for airing of issues, for expression of the views of various groups, and for feedback. Again, these will mean little unless there is adequate information and resources available for analysis outside government or industry.

Five, continuing regulation and control.

The nuclear waste management problem appears to require continuing political regulation and control to an unprecedented degree. The most dramatic aspect is the persistence of hazards over time scales well beyond the lifespan of recorded society. That implies that the measures for dealing with waste must not necessarily be dependent on organized human intervention. But it does not automatically mean the risks cannot be made acceptably small.

Clearly, this aspect of the subject needs to be given special attention early in public studies and discussion. It appears to be a rather novel issue of public policy, though in fact not so different from problems of dealing with toxic chemicals, many of which are also highly persistent in the society and very stable.

Certainly, it's easy to dramatize this issue beyond its actual significance. It may well be wise for this reason alone, if for no other, to create a new government body for the management of nuclear wastes that has single-minded responsibility for the problem. That will serve to enhance the priority accorded to the issue over a longer time and also help to separate promotional objectives for nuclear power from management objectives for handling the waste products.

Another aspect of the problem of regulation is more traditional, whether entrusted to existing agencies or shared with a new body. The history of regulation in the United States shows how easily the original basis of operation of a regulatory agency can gradually alter until it becomes the captive of the segment of society which it was designed to oversee. I won't go into the various reasons for that. I think you're all familiar with them.

There are no sure ways of preventing this from happening, though assignment of management authority to a single agency may give the regulatory problem more continuing visibility and thus more attention. Another more ambitious course of action is to develop institutions outside those directly concerned with management or regulation, to have responsibility for analysis and challenge to government policies. Regulatory agencies are more likely to be independent regulators if interest and knowledge about a subject is more widespread. Some steps along these lines have been suggested.

Let me suggest a few others of an institutional nature:

One is in the Congress. Congress increasingly provides a route for the expression of public concerns for the dissemination of information and policy options. In addition, Congressional resources for independent analysis of technology related subjects are improving through the creation of the Office of Technology Assessment, the strengthening of the Congressional Research Service and the General Accounting Office, and the development of the new Congressional Budget Office and some other new institutional developments.

Congress, thus, is coming to have the competence to develop analyses of issues and proposed policies that can provide some of that counterweight to the dominant technological capability of Executive agencies and of industry. In this role, it can serve as a route for expression of general interest and as a means of maintaining technical competence outside government and industry in complex technological areas.

Conscious development of Congressional resources for this purpose could also be a route to stagnation if the result is increased Executive/Congressional confrontation. If, however, the Executive Branch recognizes the role the Congress will play in questioning its policy recommendations on technology related issues and, therefore, reaches out earlier for more public involvement and debate, the results could be better and more timely agreement.

These Congressional resources can also play a role in the regulatory process in the sense of being alert to problems that emerge once the technologies are in place. OTA specifically has such a responsibility and could be a useful buffer against the narrowing of the decision base in regulatory agencies.

But that doesn't go far enough in the question of development of institutions. And it seems to me we need to concern ourselves with institutions involved both with advocacy and institutions that are in some sense seen as objective. As society becomes increasily committed to complex technology, the problem of competent criticism in the adversary political process that we have, becomes ever more difficult.

The rationale for this paper can, in fact, be thought of as stemming from that growing problem.

An interesting question going well beyond what can be discussed in detail here is whether and how the government in a representative democracy should see itself as responsible for the creation and maintenance of institutions designed to be analysts and critics of government policy, and of the regulatory mechanisms established by government.

Many institutions perform those functions now, especially universities and public interest groups. The resource base is often inadequate or sometimes raises conflict of interest questions. Can, should government agencies provide funds for institutional support of their critics? There has been concrete support from some Congressmen and Federal judges for just such funding to outside groups by Executive and regulatory agencies.

In discussing the institutionalization of analysis and criticism of government policy, it must be clear that there is not always an obvious distinction between objectivity and advocacy. There is a tendency to deplore individuals, particularly scientists and engineers, who use analysis for advocacy purposes. Presumably, that is because it implies distortion of the analysis or at least selective use of information.

As noted in the earlier propositions, there is inevitable pressure leading to bias or something less than disinterest as soon as a person becomes a party to a public policy issue. However, that does not mean we are doomed always to discount everyone's views--that is everyone with whom we don't agree--as hopelessly biased.

Here the traditions and mores of the scientific community and of the universities become very important; for society needs institutions both for advocacy and for objectivity.

The existing base of individuals competent to understand high-technology issues and their implications is narrow. That implies that groups involved in such an issue, but not adequately represented in the government's decision processes, are likely to be under-represented. Individuals or institutions able to work with the technology and to have access to information are needed in that avowedly advocacy role to represent those interests.

But also needed are institutions outside of government able to provide a base of expertise, not beholden to specific government policies or industrial interests, that could analyze issues and provide a base of resolving disagreements.

Complete objectivity is not achievable; but, over time, a striving for disinterestedness and reliance on scientific norms could bring confidence in such institutions and help them provide capabilities. Their authority would come from expertise and competence built up over time--not from any formal grant of responsibility. Whether such institutions should be sought among those that are already in existence, or new ones created, or both, deserves much attention and discussion.

The "science court" is presumably one such proposal; but, in my view, it is not a likely success and may even be a diversion. Other ideas are possible or have been suggested and need development. My own guess is that existing institutions--particularly universities, the National Academy of Sciences, and research centers already engaged in the task and working in the areas--are more likely candidates.

The judicial process in the United States is also becoming a major institution for the resolution of disputes related to technology. The abilty of that process to deal adequately with technology issues is very much in question and needs urgent attention and probably intervention. The development of institutions competent to deal with technologically-related policies and accepted as disinterested and reasonably objective could have an important role to play in the judicial process.

I'm impelled in this discussion to recognize that there is a cost to the authority of science and technology of having scientists and engineers operating in both advocacy and adjudicatory roles. This is likely to be a real cost. But since we already see scientists and engineers in advocacy roles to the discomfiture of some of their colleagues, there's little to do but accept it and focus on the development of needed institutions.

Lastly, let me mention something about industry. All too often in the United States today, attitudes towards business are polarized, with many seeing industry as dominated solely by improper motives uncritically arguing for reduced regulation of industry.

In fact, the technological society requires change and technological innovation. The source of that innovation, which is largely in industry, can be adversely affected by a system that makes change too difficult or removes the incentive for innovation. But imposition of restrictions with such effects can be prevented from happening only by re-establishing the trust, the reasonable confidence that the policy process will reflect the concerns of all interested parties, and not only those with narrow economic interests in the outcome.

Industry, then, must be very much a part of the measures for openness described above. Industrial motivations and objectives must be adequately and fairly represented in the process. That also implies a willingness by industry to recognize the need for full and informed

participation by other interested parties, including those who do not share the same objectives on particular issues.

In conclusion, radioactive waste management represents the kind of technologically complex and risk-laden subject that cannot be isolated from the social issues in which it is embedded, and yet which must be dealt with just because of its relation to broader social issues. It is essentially a paradigm for the kinds of central questions with which the society must deal while preserving a democratic political process. It is particularly relevant because the nature of the technology implies adequate measures over unprecedented spans of time.

The delicate balance between a regressive stalemate and authoritarian decisions about social policy must somehow be achieved. In large measure, whether we're able to do so or not will be determined by the ability to build a decision process with competent participation by those concerned and with willingness to accept the decisions that result.

Thank you.

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Mr. GREEN: We now turn to discussion by our panelists.

In my seminars I have a lot of fun when I challenge my students with the hypothesis that the decisions and the decision-making process with respect to highly complicated, technical issues will be improved if, for example, the Advisory Committee on Reactor Safeguards included a component of public philosophers, theologians, and psychiatrists. I cannot offer you a poet, a theologian or a psychiatrist, but I can offer you this morning a genuine card-carrying philosopher.

Daniel Callahan is director of the Institute of Society, Ethics and the Life Sciences, otherwise known as the Hastings Center, Hastings, New York. He has his doctorate in philosophy from Harvard, has taught at Brown University and the University of Pennsylvania. He is the author of numerous books and articles on abortion, population, and most recently a book on ethics and technology entitled "The Tyranny of Survival."

He's a member of the Institute of Medicine of the National Academy of Sciences. Many of you will recall that a year or two ago Time magazine had a profile article on 200 young American men and women whom it characterized as the future leaders of the United States society. Dan Callahan was one of those 200.

He comes to us as a philosopher who knows very little about any phase of nuclear technology. But he has thought and written a great deal about similar problems in other areas and I am quite eager to see how he will react to what he has seen and heard here.

Remarks of

DANIEL CALLAHAN, Director, Institute of Society, Ethics and the Life Sciences, Hastings Center

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Dr. CALLAHAN: In my league we would call this an experiment in human experimentation. I guess there is informed consent. Harold has given my excuses in advance so I won't elaborate on my ignorance.

Rather than comment directly on the two papers, I would like to pick up a theme which has been common here and certainly has been referred to in both the papers. That is the question of our obligation to future generations.

I take it that one of the major ethical dilemmas concerning the storage of nuclear wastes is not so much that we will have to live with those wastes but that those who come after us will. And the question then seems to be more one of "what, indeed, do we owe to those future generations?" than "what steps might we take now to discharge whatever obligations we may have?"

Let me begin in a rather simple fashion and state what seems to be some of our obligations to the present generation, to those now living. It seems in general we have an obligation to citizens not to harm people without their consent. We have an obligation which Professor Skolnikoff developed very nicely--an obligation to give people a voice in those decisions which will affect their welfare.

I think, too, we have an obligation--call it the obligation of benevolence if you will--an obligation to promote the satisfaction of the basic needs of human beings. Note that I said "the needs of human beings." We're not obliged, it seems to me, as citizens to promote all human desires.

Unfortunately, one of the major philosophical confusions in a technical society is the confusion between what people need and what they desire. The level of need in technological societies is cast at a very high level, a level which in less-developed societies would be seen as expressing more of desires than of what human beings fundamentally need to live decent lives.

If I could make my own declaration, I would say that we do not as human beings, at least in affluent societies, need a higher standard of living. We have a good enough standard now. Our problem perhaps is how better to distribute what is available, but I don't see that we have any basic need to go on. We don't need a growth ethic--though surely we desire a growth ethic.

Given that context, it seems to me that there is, however, unfortunately, little evidence that people in our sort of society have any desire whatever to curb their desires. They want to satisfy all wishes and fantasies, and want thus to go on and on upward, presumably to something better and better. I, myself, consider that ultimately foolish and I think we probably live in an ultimately foolish society for thinking that we simply can grow and improve and improve indefinitely and infinitely.

Nonetheless, that seems to be the society we're in. And in that context I think it is necessary to assume that the quest for nuclear power, the use of nuclear power as an energy source, will and indeed must continue. If we lived in an ideal world, I would personally want to say, "Stop." We don't, however, live in an ideal world of rational people and in that sense I think our ethics have to be developed in a context of not just what ought to be, pure and simple; but what ought to be, in the context of what is likely.

At this point, two things at least seem likely:

First, that the quest for continued improvement of living standards and the maintenance of a growth ethic will persist; and secondly, that we will in fact exhaust our hydrocarbon reserves sometime fairly early in the next millenium, at the present rate of consumption.

Given those two reality principles, it seems to me that we must go ahead with the development of nuclear power, the development of nuclear energy sources.

Therefore, it seems to me that our main obligation, given that reality, is that we must now get on with the work of developing those sources and we must also willy-nilly, but perhaps something more rational than that, run the considerable danger which that development brings with it. Given that context, what can be said about our obligation to future generations? (By this, I mean those generations which are three, four, and more generations away. When I speak of the present generation, I'm speaking primarily of our generation plus the next two or three successive generations. By future generations, I would mean those who are much farther down the road.)

It seems to me that our first obligation is not to leave them worse off than we are at present. They should have at least as much

potential for their future as we have for our future. And secondly, I think that we ought to act in such a way that we do no harm so basic to the environment that they cannot undo that harm.

Now I think if we are not willing to give up what I consider the lustful search for higher standards of living or the growth ethic, we must then take steps which will minimize the risks to which those future generations will be exposed. We must, to put it very briefly, leave them freedom of movement.

My own feelings--as I've examined in a very amateurish and superficial way the literature--is that I personally am not convinced that we need to devise a permanent and absolute solution, good for all time, to the waste disposal problem. We need only a solution which will be safe for the next few generations, and a solution which would allow those who come after us three or four generations down the road to be in a position to themselves take the next step in solving their own future problems.

If I may use an image, I would use that of a kind of relay race. We probably cannot solve for all time the waste disposal problem. We need only to devise a solution--whether that's conceivable or not, I will leave to others--we need only to devise a solution which will allow us, so to speak, to pass the baton on and let those who take it be able to act with that enormous impediment.

I would also want to argue that if we continue our present consumption patterns of energy, depending only upon the hydrocarbon fuels, then we will be acting most irresponsibly--if we do nothing in looking toward the day when they run out, or if not run out, are in such short supplies as to create ultimate social chaos. Given a choice between that latter form of irresponsibility (of doing nothing whatever) and the known dangers of nuclear power development and the storage of nuclear wastes, it seems to me that the latter danger is to be preferred.

That's a very brief argument which I can develop further during the discussion period.

Let me say a final word, however, about public participation. I mentioned to Professor Skolnikoff last night that it seems to me that we have really not confronted the very interesting and difficult question of what public participation means in the case of making decisions which will affect future generations, when we cannot in the nature of the case have those in the future participate in that discussion. That seems to me to raise a very special and difficult kind of issue.

I would only note, however, that while it's pretty evident that there are various initiatives against the siting of power plants and

the like in various states, I'm not sure exactly what the moral significance of that is. I'm struck with the fact that--unfortunately, an aspect I think of technology affluence--we do live in a society which seems to want things both ways.

It is not only that we don't want nuclear power plants in our backyard. It turns out that we don't want old-age housing in our backyard. We don't want housing for low-income groups in our backyard. We don't want half-way houses for drug addicts in our backyard. We don't want de-institutionalized mental patients in our backyard. In short, if one wants to think of some of our social waste products of a technological society, it seems that we all want all of our problems solved, but we don't want to have to live personally with any of the likely solutions.

It seems to me that if we're going to have initiatives, if we're going to have various groups protesting the location of our waste products, human or otherwise, in our midst, we are somehow going to finally have to fish or cut bait.

Either we're going to have to give up the advantage of the general solutions we're looking for, or somehow we're going to have to learn to make those kinds of personal sacrifices to live with the hazards which, at present, people don't seem at all willing to live with.

Thank you.

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Mr. GREEN: Our next speaker, David Rose, although not a lawyer, lives by the lawyer's ethic; to wit, I don't care what you say about me as long as you spell my name right.

Within a few seconds after his arrival here today, he informed me in no uncertain terms that his name was misspelled in the program. He is not David V. Rose. He is David J. Rose. I trust you'll make the necessary adjustment.

Dave Rose is a professor of nuclear engineering at Massachusetts Institute of Technology. He has been in that position since 1958, with some deviations. From 1969 to 1971, he was director of long-range planning at the Oak Ridge National Laboratory. In 1968, he was visiting scientist at the U.S. Atomic Energy Authority. Prior to MIT, he was a scientist with the Bell Telephone Laboratories.

It gives me great pleasure to introduce Professor Rose.

Remarks of

DAVID J. ROSE, Professor of Nuclear Engineering, Massachusetts Institute of Technology

Professor ROSE: Good morning. I apologize for coming here only this morning and not having shared with you the rest of the important debates and discussions. Unfortunately, I had to be in Boston until late last night. But I've read the papers, the advance versions, and have played in this area a little bit before. So I'll make some comments.

On the two papers that have just been given, some remarks about Professor Skolnikoff's presentation: He points out that one gets assessments that tend to be one-sided or at least to present a point of view which then makes it difficult for somebody else to critique in a fair way. Also, I point out that it is very hard to commission a review of a study or a critique of a study before the study has been made.

One can, of course, fund studies by groups supposed to be pro and con--although it is not always possible in advance to tell what is "pro" and what will be "con"--but this adversarial process doesn't work in the present public sectors as it does in the courts of law.

I think using the adversarial process as a paradigm is a poor thing, because a fundamental piece is missing. There's no judge in the middle. As a result, one finds the advocates of one view or another railing at each other, throwing stones at each other, and no one keeping track of good order or decorum.

Regarding the Congress, it is the surrogate of 215 million people, so it makes policy decisions. It isn't always that great and I think you'll all agree.

Also, the OTA has tended, unfortunately, at times to be timid. I hope that it stiffens itself up to face some of these questions.

I feel very uneasy about solutions or approaches to these problems that tend to be amoral. I don't mean immoral; I mean amoral, as if one can analyze them to death because they have very large ethical and moral content. And I'll come to that a little later.

Regarding Professor Abrahamson's paper: My understanding of the

Swedish election is a bit different. That is that the Center Party actually lost power. Although, to be sure, Mr. Falldin ends up as the new prime minister, the complications are much more than one gets by just seeing who's in and who's out.

Also, the critical question to be asked here is whether this performance of nuclear waste management--which has been inadequate as Professor Abrahamson points out--will it be projected into the future or not?

If it will not, then our problems will clear up. If it will, then our problems will not clear up. And that has to do with the nature of people and the nature of institutions. History doesn't tell us very much about whether these problems will assuredly be solved. Early steam engines were very hazardous, but they were improved to our benefit. Ancient weapon systems were hazardous, too; and they have been improved--but not to our benefit. So, you see, it is a complicated business.

Now I have a few more comments which I actually wrote out, about five points or so.

I'd just like to see both here and in the preceding sessions an increasing recognition that no technological or social arrangements can be made "perfect" or risk-free or acceptable without exception. Thus, the question of "compared to what?" starts to be addressed more meaningfully.

As a corollary to that, I raise two points:

First, the statement that the decision process must be seen to be fair in addition to being fair, a point made by many people--that has limitations because we can be the hostage of one untruthful person who says that it is not fair.

The second thing has to do with risk-free options. Eric Fromme, a psychologist and philosopher, wrote eloquently on that issue in a very short article in the New York Times in December of last year. "Consider," Fromme said, "someone who will not touch a door knob because he might pick up a germ of some fatal disease. We could call such a person paranoid. But at the same time, we could not assure this person with absolute certainty that it is impossible. Thus, a person would be simultaneously paranoid and also logical. And we see the difficulty that comes along with insisting on absolute security."

Fromme then goes on to make the point that no activities are risk-free, that all must be viewed in comparison with alternatives. A person who insists on absolute security, and will go to any lengths to attain it, will paradoxically decrease his overall security by expending inordinate and inappropriate resources with one purpose to

the neglect of the others. He was not speaking of the nuclear waste problems; he was speaking of our foreign policy. But it fits here well enough.

The second major point that I will make is rather simple. By reading all I can of the papers submitted to this conference, I see few fundamental disagreements; I see personal preferences peeking out between the words and phrases. And that is natural.

The third major point relates to mortgaging the future, a point made by the previous speaker and made by many others. The point is often described as being peculiar to nuclear wastes. It is by no means unique, as we consider fossil fuels and other things, too.

Plato wrote about how all the trees were cut down in Attica for fuel, leaving behind a land that was a skeleton of its former state. And Rome fell from social collapse stimulated in part by loss of fuel and food within easy transport distance of the city.

Watch out for the biomass solutions to the energy problems. We use up gas and oil and leave a poor earth to those who come later. If you ask somebody about his concern for 100,000 years from now and he says it's great, then you'd better ask him how much oil and coal he is using now. If you want to use oil and coal at the rate that God makes it anew, then your lifetime supply of coal is about two kilograms and your lifetime supply of oil is about 100 milliliters.

Fourth, we see developing a more-or-less common attempt to treat this problem via what has come to be called the "process of technology assessment." The NRC paper is notable in this respect. Regarding issues of implementation, I see several large gaps that should have appeared in any rational technology assessment, and I don't see them in any of the papers.

One gap--the needs and opinions of other nations. Professor Skolnikoff's paper mentions it, but almost en passant. I think that a large sector of the world is going to go nuclear and we are parties to the debate willy-nilly. The majority of the papers here promote the view that the nuclear waste problem is not local, neither in space nor in time. I agree. Thus, it behooves us to join others in seeking acceptable solutions.

But what do we mean by that? What do we mean by "acceptable," as Professor Abrahamson asks? It depends on many things--perceptions of opinions; options, closed; perceptions of options left open to the future for various times as was discussed before.

Also, coming into this technology assessment and how to implement some kind of plan, we have a large waste disposal problem now alluded

to by reference to the weapons waste, and what will be done with that festering mess?

Estimates run to $20 billion or more to clean up the Savannah River in Hanford, Washington. The same persons who in the old AEC were suppressing information about that problem until the early 1970's, were simultaneously saying that commercial nuclear wastes would pose no difficulty. An aroused public may actually demand that these wastes be cleaned up just as a sign of earnest intent. And that hasn't been discussed to my knowledge here.

Also, the relative comparisons--a social cost in time and space of other options, as I mentioned before.

A fifth major point: How did the problem get this way? How did the debate get so disheveled and the quality of the discussion so poor? Something is missing. Something is wrong.

We live in and reinforce an uncharitable society. By "charity" I mean in the sense of the Latin caritas or the Greek agape which go hand in hand with "trust." People fight each other because they do not get their way in everything every day. And that can be said for some on both sides of these issues, both those that want to produce power and those who do not, those who want more and those who want less, those who would impose their views upon others without thought of what the others might wish.

Understanding, trust, and charity arise from knowledge and wisdom, but not just from those alone. The issues require public decisions, as we all agree.

I persist in the belief that the way to ensure good decisions is to have a well-educated and well-informed public. That is the guarantee against tyranny, whether of bad rulers, of bad ideas, or even of bad technology. This is an unabashed proposal of Jeffersonian democracy, a form upheld as an ideal, but ignored very much in the practice.

Technology has outrun public understanding of it, of its importance, of its consequences, and of the consequences of doing without it. When our educational systems--both in the classroom and in the rest of life--do their proper work, then problems like this will be much more easily resolved.

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Mr. GREEN: Our general chairman, Alan Campbell, would like to make a few comments. Immediately upon the conclusion of Dr.

Campbell's comments, we'll take a brief recess for purposes of a stretch. In order that we can accommodate the maximum possible questions from the floor, I intend to resume this session precisely 180 seconds after Dr. Campbell concludes. You might take advantage of the three-minute break to get up to me any questions you would like to have put to the panel.

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Dr. CAMPBELL: Very briefly, you are undoubtedly aware that the President yesterday issued a statement about nuclear proliferation and other matters related to nuclear power.

We, unfortunately, do not have enough copies of the press release to distribute to everyone. However, there are copies available to read in the ERDA Resource Center; and in addition to that, as some of you may have noted, the Energy Daily does carry a summary of it.

I would merely point out that the statement argues, to use the exact words, that "the U.S. and other nations can and should increase their use of nuclear power for peaceful purposes." And then there are several statements concerning waste management and I refer you to the Energy Daily about that, because it carries them specifically.

Secondly, indicating the kind of public concern which exists about the topic with which we are concerned, the Conference has received a telegram which I will read:

"I would like to express my strong support for the kind of public dialogue provided by your Conference on the public policy question surrounding radioactive waste management. Your recognition that nuclear waste management is not just a technical issue to be left to the scientific experts, but a crucial policy choice for the American people, is a healthy and positive step in the beginning to deal with this important issue. I am grateful for the participation of so many experts in your discussions, and I look forward to reviewing the text of this Conference. My best wishes for a full and productive meeting. Sincerely, Jimmy Carter."

I also point out that a summary of the goals document which was discussed yesterday morning will be available--500 copies of it, enough to go around. It is supposed to arrive at 11:00 a.m.

Thank you very much.

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Mr. GREEN: Will you please take your seats so we can get underway?

Our next speaker is Barton Z. Cowan. He's a graduate of the University of Michigan and Harvard Law School. He is a partner in the Pittsburgh law firm, Eckert, Seamans, Cherim and Mellott.

Because he is a lawyer, he, of course, approaches the task at hand with a relatively uncluttered mind. He does bring with him some clutter, however, since for the past 10 years he has been heavily involved in legal aspects relating to nuclear technology. During the past five or six years, the majority of his professional time has been devoted to problems involved in the licensing and regulation of nuclear power facilities in connection with his representation of a major manufacturer of nuclear steam supply systems and other plant hardware. He was involved as one of the counsel in the notorious Emergency Core Cooling System proceedings, and he is currently involved as one of the counsel in the so-called GESMO proceedings and is a consultant in the Clinch River Breeder licensing case.

He also spends a portion of his time on environmental matters, including state proceedings concerning fossil fuels and nuclear power plants. It gives me great pleasure to introduce Bart Cowan's uncluttered mind.

Remarks of

BARTON Z. COWAN, Attorney, Eckert, Seamans, Cherim and Mellott

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Mr. COWAN: Last week when I spoke on a platform where Harold Green was the moderator, he said that my presentation was one of filling in the blanks. So I think I've gone from a blank mind to an uncluttered mind. I don't know if there is a distinction there or not.

Let me begin by saying first a word about bias. I don't believe personally that people either inside or outside of the nuclear industry, whether they're engineers or scientists, or lawyers or social scientists or what have you, become suspect in their views merely because they become more and more involved in their work. As Professor Skolnikoff said in his comments, we are not doomed to discount everyone's views as hopelessly biased.

I think there's a great danger for the public to perceive the issue of waste management implementation as a black hat/white hat issue.

I don't think it is. I don't think anyone has a monopoly on the "truth." And I dislike seeing implications that one side may be searching for candor and the other side may be made up of men of perhaps questionable moral sensitivity who don't want to deal with the issues. I think that does a disservice to the quality of the discussion and the soundness of the outcome.

As to my perception of the issue involved in implementation--I'm sure they are colored by my experiences, appearing as a lawyer representing a part of the industry, when proposals for implementation, if you will, have been put under the scrutiny of the National Environmental Policy Act of 1969.

In the Conference program which we all received, the purpose of this Conference is said to focus on issues which should be considered in the Environmental Impact Statements to be prepared in connection with the making of decisions on nuclear waste management.

As you know, NEPA requires, among other things, that the decision-making process has to take into account a consideration of alternatives to the cost up to the proposed actions. And the culmination of the NEPA process is the risk/benefit analysis in which the action under consideration is weighed in terms of the gains which will accrue to society from undertaking the action proposed, and the risks or the costs which are involved to achieve those gains.

As I apply the NEPA methodology to the subject at hand, I find I would add several questions to the list which Dr. Abrahamson raised during his presentation.

First, what are the costs and what are the benefits of not taking action, timely action, on any one of the several alternatives for nuclear waste management implementation?

Second, what are the costs and what are the benefits of those alternative actions if, as Dr. Abrahamson suggests, the adequacy of local waste management objectives are to be judged as a part of the broader question of the acceptability of nuclear power?

My bias is that a consideration of the issues raised here cannot be done in a vacuum without an exploration of the alternatives. And what is needed is a sense of balance.

The questions raised during the presentation by Dr. Abrahamson seemed to me to be relevant to ask. But I would fault the list for not including the NEPA imperative of consideration of the alternatives. This is not to say that I agree with the conclusions of Dr. Abrahamson or at least those which I think were implicit in his remarks. I detected an undercurrent of an anti-nuclear power theme which obscures at least the validity of some of the points which were raised.

And part of the matter which was raised, it seems to me, wandered somewhat far from the issues involved in this Conference, "public policy issues in nuclear waste management," and dealt with the larger question of nuclear power acceptability.

I again refer to the Conference program:

"It is not the purpose of this Conference to debate the acceptability of nuclear energy." And yet discussions about growth and whether growth is good or bad involves just such debate.

Since growth has been raised, I want to make a couple of comments concerning it. I agree with the article heading and the conclusions of the articles which appeared some months ago in the New York Times Magazine section. That article was headed "No Growth Has to Mean Less Is Less." To me, this has serious adverse consequences for our society and the world.

If we enter into a "growth/no growth" debate, NEPA demands--and I think a rational debate demands, even apart from NEPA--that we consider the consequences of "no growth." It is not an answer to say that we are trading small present gains in welfare for large losses of future welfare, because I think the implementation of "no growth" can lead to just as much, and perhaps more, coercion on the local front as we try to ration down the road--and can lead to more disruption on the world front--than the implications of "growth."

I'd like to make a couple of observations on the paper presented by Professor Skolnikoff. I thought it was especially telling in its statement that the propositions about technology in the public arena have to be kept in mind in coming to grips with issues involved in radioactive waste management and in carrying out decisions reached. I wish, however, that he had had time here before you to develop certain themes inherent in those propositions, to a further degree.

For example, as now appears obvious, there is no such thing as a riskless technology. This is frequently forgotten, or at least not presented, in the debates over both nuclear power and nuclear waste management. No doubt it was the constraint of time that caused Professor Skolnikoff to limit his remarks in this regard. I hope we can bring some of them out in later discussions.

When his presentation turned to the series of approaches and policies which he deemed relevant to the goal of an "open and fair policy" political process, I find I differ with some of the approaches suggested. For example, he seemed to suggest that the role of Congress should be substantially expanded beyond the establishment of options and priorities and the creation of the administrative framework within which to carry out these options.

While Congress no doubt needs to have the capability for an independent analysis of the adequacy of the job which it has mandated, I personally do not believe that that capability should have as its implied goal the establishment of another bureaucratic layer that can or should act in the guise of a quasi-regulatory agency.

To me, the proper role of an independent analytical organization advising the Congress is to provide the Congress with the appropriate information, utilizing the best management techniques known, as to the adequacy of the job being performed by the independent regulatory agencies--which are the creatures of Congress--and by the Executive in the energy field and in the field of nuclear waste management. When we get Congress mixed up in the direct role of trying to do direct regulation through an advisory group, I think we are headed for trouble.

I also believe that the paper of Professor Skolnikoff underestimates some of the difficulties inherent in implementing some of the other approaches suggested in his presentation.

Let me say a word about openness and candor, or the need to establish trust as it's been put here. I think the need is well perceived. The real question is, how do you do it? Openness and candor, I find more often than not, are essential; but, alone, openness and candor will not establish the trust. There is no doubt that there's a need to restore confidence. And I don't think there are any simple answers, maybe because all too often the trust--and hence trust--is in the eye of the beholder.

However, I believe that if the public is informed about the alternatives, about the consequences, about the benefits of the various paths, the public decision will come out--and I do not fear for that decision.

I don't happen to think that the decision is necessarily best which is made while undergoing cross-examination in an adjudicatory proceeding. There are limits on the use of the adjudicatory and legal process, in terms that a lawyer thinks of them in the courtroom, in arriving at public policy decisions. And I suggest that implementation of nuclear waste management alternatives will run up against those limits if the techniques used by lawyers in courtrooms over the past 200 years are attempted to be applied in deciding which way to go and what to do.

Perhaps, in the final analysis, the overall nuclear debate has become too polarized to expect that any presentation of one aspect of that debate--whether it's nuclear waste management, or reactor safety, or low-level radiation releases--can be adequately addressed in a manner that's balanced and objective. But ultimately the judgments as to whether the risks associated in nuclear waste management or in other

aspects of the nuclear debate are acceptable, in light of the benefits to be gained, must be considered in public forums such as this where rational debate can occur.

We can't begin to address the issues until we open up the process. I think the process is a lot more opened than some of the comments would suggest, and I think this forum has provided a good start in opening up many of the issues.

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Mr. GREEN: Our final panelist this morning is Dr. Roger E. Kasperson, professor of government and geography at Clark University in Worcester, Massachusetts.

Prior to his present appointment, he served on the faculties of Michigan State University and the University of Connecticut. He has written widely in the field of political geography, citizen participation, and environmental policy. A study of his on the diffusion of waste reuse systems in American cities will be published early next year by the University of New England Press.

For the past two years he has served as the director of Project RARE, a study funded by the Ford Foundation concerned with disaster prevention in the nuclear energy programs of Canada, the United Kingdom, and the United States.

Dr. Kasperson.

Remarks of

ROGER E. KASPERSON, Professor of Government and Geography, Clark University

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Dr. KASPERSON: In commenting on these two papers, I shall address myself to the larger issues raised by the authors; namely, the nature of the public policy process that we're talking about, and the strategic options open to society at this time.

Beginning with the first, it is essential at the outset to place the public policy issue in perspective.

In our sensitivity to the distinctive qualities of the radioactive

waste management problem, there is a danger that we may overlook the degree to which it shares a number of characteristics with other technological problems facing society. Professors Abrahamson and Skolnikoff have pointed out that in fact there are a number of hazards; now with Professor Rose's help, we include the foreign examples, which also involve long-term, highly uncertain, and possibly irreversible, change.

These commonalities, however, extend behond questions related solely to the nature of the hazards. The belated societal response to the radioactive waste management problem is part of a much broader picture: the growing inability of society to deal with the proliferation of technologically-created risks.

A study soon to be published, analyzing some 45 recent hazards arising from technological growth, will show that early-warning signs of danger were missed in some 40 per cent of the cases, that in three or four cases no one seemed to be really on top of the problem at its onset, that in half the cases the problem was allowed to grow even after the danger became apparent. Particularly problematic were those cases where information was scanty and/or disputed by experts.

From what we know about society's response to technological hazards then, the radioactive waste disposal issue should not surprise us. In fact, had not the nuclear controversy erupted earlier over other risks in the fuel cycle, it is entirely possible that the waste disposal hazard would have escaped society's attention and that this Conference would not be taking place. So while it is surely appropriate to lament the failure to develop the needed technology and to complete a comprehensive risk assessment for the entire nuclear fuel cycle, it is also important to understand the extent to which this issue is a sign of the times.

On the other hand, any effort to characterize the radioactive waste disposal problem as simply one of a broad class of hazards may seriously mislead policy makers. Whereas hazards may be compared in generic characteristics, policy issues assume meaning because of their location in a particular web of events, institutions, and experiences.

Paradoxically, comparisons of the radioactive waste disposal problem with other technological hazards may well reveal common elements, and yet simultaneously conceal the real nature of the policy issue. The essential question is not how the experts in the conference define the hazards, but how the Jane Doe's of the world see it. And, there, I am concerned that the sands of understanding now slip through our fingers.

As Professor Slovic pointed out earlier in this Conference, our knowledge of the public's definition and assessment of the waste disposal hazard is rudimentary at best. Yet the evidence to date suggests that deep-rooted public concern.

The 1975 Harris Poll and the 1976 Canadian National Survey both found that the waste disposal problem ranks surprisingly high among the perceived disadvantages of nuclear power. Surveys conducted by my colleagues and myself in Canada, the United Kingdom and in the United States over the past two years confirm these findings. Professor Abrahamson has pointed out that nearly all of the state initiatives which have qualified for the ballot, or are in process, include some radioactive waste disposal provision.

In Sweden, I share, I think, Dr. Rose's skepticism about the participant and press accounts and the degree of exaggeration of the nuclear issues that may be involved in them; on the other hand, it is clear to me that concern over radioactive waste disposal and nuclear proliferation seem to be the two major issues in the Swedish disenchantment with nuclear energy.

Thus far, the dominant public concern has been conceptualized as being over long-term safety. The Battelle study of public values associated with nuclear waste disposal, of which we heard from Professor Slovic yesterday, clearly revealed that of the four factors studied, long-term safety was a major public concern.

Yet I wonder whether the concept "long-term safety" encompasses adequately the scope of public apprehension over the intergenerational issues in radioactive waste disposal.

In the Battelle research, the most dramatic differences in values occurred between nuclear technologists who see short-term safety as the most significant problem and environmentalists who rate long-term safety issues substantially higher than all other groups.

The reasons for this, I suspect, is that suggested by Professor Abrahamson: Environmentalists and much of the public have embraced the ethic of man's stewardship over the earth to as great a degree as possible one generation should not irrefutably despoil the earth for future generations. Now while we as scientists might rise to our feet to contest the romanticism and/or myopia in this ethic, such a protest will do little to resolve the realities of the public policy issue; and that is the issue at stake here today.

There is also evidence of concentrated opposition among those in our population with medical concerns. Even if it could be established that the long-term risk of waste disposal approached zero, there could still be strong public resistance to the program, especially among women.

I might note parenthetically, if you're not aware of it, public opposition to nuclear energy--and I suspect to waste disposal--is highly concentrated in women. If you want to explain that away by an argument that women are less informed and have less knowledge than men, you

might be interested to know as they accumulate more knowledge, their opposition grows, not decreases. The same is true of men, but particularly, and more so, of women.

Similarly, if firing wastes into outer space were feasible and nearly risk-free, it could well also prove entirely unacceptable as public policy.

Augmenting this general argument is the fact that radioactive waste disposal shares some of the larger issues of nuclear power, issues which are distinctive if not unique among other technological hazards. One part of this distinctiveness arises from the origins of nuclear energy and the other from its collision with the broad-base social movement--the environmental movement. Nuclear energy, as Elizabeth Gray so vividly brought home to us yesterday, generates public concerns exceeding the actual risks involved because of the anxiety associated with the fear of nuclear war and of cancer. A broad range of public opinion research lends empirical credence to this hypothesis.

The second source of distinctiveness lies in nuclear energy as a centralized complex technology managed largely in Washington. It collides head on with preferences of the environmental movement for decentralization, low-level technology, non-growth, and grass-roots participation.

If this characterization of radioactive waste disposal as a public policy issue is at all correct, it is entirely possible that while technological issues may be soluble over the short run, the public policy problem by contrast may well prove to be relatively intractable. One, the surrogate of safety, either long-term or short-term, may not incorporate all elements of public concern, particularly those that are non-cognitive and ethical in nature. Two, the creation of demonstrative technology in probabilistic risk assessment a la the Rasmussen study may, therefore, fail to allay existing public concerns. And three, given the reality that the environmental movement is at war with nuclear energy as a technology and that waste disposal is simply one of the battlegrounds of this war, one should expect a nuclear conflict to persist whatever the solutions over the short term.

I'll skip over some comments that I had on institutional questions, though I should note my agreement in substance with Professor Skolnikoff's analysis, and turn to the question of strategic options. This major aspect of the policy issue I think is concerned with what I believe to be two major strategic options facing society at this time, either overwhelming the problem with a crash effort or instituting a more deliberate process which provides time for societal clarification of issues in debate. The choices represent horns of a dilemma, for both threaten nuclear energy prospects in different ways.

Nuclear energy regulation, perhaps because of the undue emphasis upon reactor design and quality assurance as the major means of assuring nuclear safety during the 1960's and the resulting incomplete assessment of fuel cycle risks, manifests a history of timely response to risk followed by a massive but hurried-up effort to, if not resolve, overwhelm remaining doubts and opposition so as to keep nuclear energy on an even keel. Both the Emergency Core Cooling saga and the current rush to assure safety against theft and sabotage illustrate this process.

The legacy of lost opportunities for progress on the waste disposal issue over the past decade has some important implications for the current situation. While one can perhaps accelerate risk assessment fivefold or sixfold over several years, public policy is often not amenable to the same type of speed up process.

Where the issues are highly uncertain, laden with troublesome ethical considerations and have a history of rancorous conflict, time is needed for the weighing of conflicting information and for negotiation and compromise among contending forces. And it is not enough that we have an open decision process, of which we've heard so much during this Conference, or that a chance will be given for the public to comment on drafts or voice in its views at hearings.

Any effort to override public reservations before the emergence of societal consensus could well provoke a new round of challenges to existing institutions, detract further from the legitimacy of existing policy-making processes, and needlessly endanger the future of nuclear energy as a whole.

A more prudent decision process--which strives to internalize the policy conflicts over radioactive waste disposal in new and existing institutions, works for increased credibility and legitimacy among friend and foe alike, and provides the desperately needed time for social institutions to grind and digest policy issues--carries its prices as well. Further delay in an already seriously disrupted schedule for new and planned nuclear plants will exacerbate the growing economic problems and perhaps threaten the momentum of decisions on nuclear energy.

But past mistakes have their prices. The risk assessment research and public discussion of issues connected with the back end of the fuel cycle with willful human acts of sabotage and theft and with nuclear proliferation to allow for public policy acceptable to society, simply have not occurred. In fact, the policy issues may not even yet be well defined, much less adequately debated. And existing institutions may not, as Professor Willrich has suggested, be equal to the task.

In this context, and I conclude, any attempt to overwhelm current societal reservations and conflicts with an Environmental Impact Statement alleging essentially zero risks from radioactive waste disposal would be--in my view--a tragic error, one destined to intensify rancorous debate and detract from authoritative resolutions of the waste disposal problem.

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QUESTION AND ANSWER PERIOD

Mr. GREEN: I have a bunch of questions. I assume there will be some more on the way up. I would ask the panelists to try to be crisp and brief in their responses in order that we can cover as many questions as possible. In order to set the tone and start with a simple question, there's one for you, Dr. Callahan.

Reference is made to "Leviathan" written in 1650 by Thomas Hobbes in which Hobbes argues for the need of every person to cooperate in collective society in order to preserve the basic safety and mutual support. Do you think that is relevant?

Dr. CALLAHAN: I would say, yes, materially relevant. I would also remind people that Hobbes felt that the state was basically built upon a fear of death.

Mr. GREEN: I guess, Dr. Skolnikoff, the next one is for you. What do you view as the role of the state governments in developing and exercising the functions of developing and providing for competent criticism?

Dr. SKOLNIKOFF: Mason Willrich and others touched on some of that yesterday. Clearly, the closer you get to the public at large, that is the more you move down away from Washington and towards the local level, the more opportunity there can be for reflection of local views. And that is obviously an important part in any process of debating what are the issues really at stake.

I think it's a mistake to assume that discussions at a local level are automatically going to be more candid, open, and more satisfying in the sense of exposing all of the issues than discussions at any other level of government; because they, too, are often beset by problems of bias that can color the debate and put a different kind of a framework around it.

At the state level, I don't have anything very substantial to say. I think there is a problem that was brought out yesterday very clearly about what happens in a process in which every state has a major regulatory role which may be different in a different framework, different set of guidelines and conditions, than on the Federal government level. And I think there is a need for some kind of uniformity across the country.

I agree also with the point that Dave Rose mentioned that we have to recognize the important international aspects of this as well. But I don't have any specific comments about the state governments' role except to say that it is what I said at first--a very important part of the expression of local views in the general process.

Mr. GREEN: Dr. Abrahamson, you are criticized for articulating "an uncluttered moral absolutism" in the politics of technology. And in that connection, you are asked why you failed to cite the evidence of the acceptable and benign effects of radioactivity present in the natural world.

Dr. ABRAHAMSON: Could I have the question? Just for clarification I wanted to read it again: "How can you fail to cite evidence of acceptable and benign effects of radioactivity present in the natural world?" Well, if somebody can demonstrate that to the satisfaction of those bodies responsible for setting exposure standards, I think it would be a relevant question.

It's clear the assumptions being made, involving the dose-response relationships of radiation to human health effects are those things upon which those standards rest in low-dose regime, are assumptions. That is, it is not proven that there is a zero threshold. It's not proven that it's linear in the low-dose regime and so forth. Those things are taken as assumptions for purposes of establishing standards. And the whole discussion of response to low levels of radioactivity is based on that set of assumptions. And I don't believe and the literature doesn't reflect that natural radiation is benign.

One thing I'm curious about, very curious about, and that is why the public perceives the risk from radiation from the nuclear industry to be substantially greater than that from the medical industry. I've always been curious about that. I tried to stir up the physicians a little bit to talk about it, and it doesn't get anywhere.

Mr. GREEN: I have a question addressed to Dr. Skolnikoff but I suspect that Mr. Cowan will probably desire to comment. You are asked, Gene, whether it is not true that considerations of industry proprietary profit are the chief source of the lack of credibility of the experts' assurances of public safety.

Dr. SKOLNIKOFF: I'm not quite sure how to answer that. I'm not quite sure I understand the question. The question is meant that the perception of industrial bias, economic interest, is the cause of the lack of credibility of industrial information. If that's presumably the question, I think there obviously is an attitude at large that there's a sense in which industry and the economic interests that are represented cannot, therefore, be trusted to provide information that is going to be completely open or that may point to conclusions adverse to the economic interests of the industry involved. And I think there's a public perception of skepticism along those lines.

I would emphasize that, in practice, it's not restricted to industry alone, though that may be the most serious area of perception. Certainly government agencies, for example, have been known in many cases inside and outside of government to provide information that tends to support the particular position they want to take rather than making information available that might conflict with their policy goals. That's not surprising. Everyone does it.

One of the major problems of policy making inside government is how to get accurate and adequate information out of the various departments of government that may not necessarily support the position the particular agencies want to take. That certainly was the reason, for example, for creation of the White House Science Office by President Eisenhower in 1957; he came to realize, as he had known all along from his Army days, but came to realize more fully, that he could not depend on the objectivity of the information being presented to him on weapon system information.

So I think it is not surprising that people behave in what they see as their own best interests in release and in the attitude they adopt towards information and analysis. I think the problem is that industry has a particular load to bear because of the perception of the public that information from industry is likely to be governed by economic interests as opposed to simply policy preferences and, therefore, there's some special opprobrium that's attached to that.

Mr. COWAN: I would only add that I think that the perception of industry as having economic interests at stake is a source of some of the credibility problem. It is certainly not, in my view, the chief source, as I think the question stated. I think there are other reasons why we have a credibility problem within the nuclear power community, and industry is only one aspect of that.

One of the interesting things to me is the apparent failure to recognize that, in the final analysis, if the problems are as severe as the critics of industry suggest, the economic interests of industry are to solve those problems or the industries involved will go under. And that frequently is not recognized in the credibility problem.

Mr. GREEN: Dr. Kasperson, you are complimented on your astute identification of unique concerns of radioactivity risks in its public manifestation as being nontechnical and as being hazard and discontent surrogate, primarily for women and nontechnologists. And you are asked in that connection how such political and psychological science can be more directly integrated into the decision-making process.

Dr. KASPERSON: First of all, I'm not sure that I agree with the way that my position has been characterized, so I should put that record straight, I think, at the start.

One of the issues is that the notion of risk needs to be expanded in a larger sense. I would argue, for example that the notion of risk has been largely treated as risks to man, to people. And any risk to the biosphere has been treated largely in the sense that the changed biosphere may then pose some risks to people. I think quite independent of that, there is a concern with the risk to the biosphere, particularly risk which is irreversible. And, thus, my comment that even if the risk to man could be stated to be near zero, that might not resolve the problem.

The second point is--what I'm trying to get at is something that I think Paul Slovic was taking apart very carefully and looking at analytically; unfortunately, he could have used more time to expand those points--human response to risk and to different types of risks are different. Risk can't be simply aggregated and then compared from one technology to another in terms of how the public responds to it. The public responds differently to different risks. Therefore, all risks can't be reduced down to some common denominator as a quantitative figure would give us, at least for the sake of public policy.

I would argue from this that the nature of the public response to the risk can be analyzed in the sense that the public weights different risks differently. So one can then appreciate the fact that even though one risk may be small, the public apprehension connected with it is very large. In fact, one could quantify that. One would have to do it for different groups in society, but, in a way, the Battelle study did at least part of this and suggested ways that that can be done.

We need to be much more concerned with not only defining and coming up with a technological assessment but essentially the same-scale effort into what the public response to the risk assessment is, what are the public apprehensions. I raised a question to the goals management group which is that almost everybody who's looked at citizen participation has pointed out the crucial importance of as soon as you start defining goals to start defining what are the goals in the public mind. What are the nature of the apprehensions and so forth? And I would have liked to have seen a very strong psychological

component going into that goals segment because the danger is that the goals we may identify may be either not the goals identified by the public or very low priority goals.

As a way of trying to do this analytically into the decision-making process, I'd recommend to you in the current issue of Science a very interesting article about the implications of looking at social values in the decision-making process.

Mr. GREEN: Dr. Rose, you are asked whether in view of the growth and healthy functioning of groups opposing nuclear power the press should not extend its role of critical assessment and its demand for ethical conduct to such opposition groups as well as to the proponents of nuclear technology.

Dr. ROSE: There's something in there about "if you stop beating your wife." Do I believe the press ought to do this? There's a presumption in there that it hasn't. I think probably the press has not excoriated some of the bad critics, and that's a value judgment as well as it has excoriated some of the bad proponents of nuclear power. The reason is pretty clear and that is that such beating of the establishment tends to sell papers. So there is a call for responsibility. But most everything I've read in the paper about anything I have to do with it is wrong, so I don't have a great deal of faith in the public press at the moment

Mr. GREEN: Thank you for the crisp answer. I hope all of the other panelists will be equally crisp.

Dr. Abrahamson, let's try your crispness on this one. The statement is made with reference to a recent pronouncement of the National Council of the Churches of Christ pronouncing the plutonium and plutonium economy as immoral. It is stated that scrutiny of this pronouncement by moral philosophers strongly questions the ethical analysis used, on the ground that the pronouncements seem to be more emotional than ethical. And you are asked: In view of that stated deficiency, through what type of forum should the moral issues of nuclear waste management be addressed? After you're finished answering that, it is requested that Dr. Callahan state his views.

Dr. ABRAHAMSON: All right. There have been a number of comments in response to the recent pronouncement of the National Council of Churches. And I think we can look for a continuing series of resolutions on these matters. Some people like it; some people don't like it, and so on.

In trying to prepare for this meeting, I got as many papers as I could lay my hands on written by folks that I thought could help me tell a moral issue from an ethical issue from a social issue. I was

left rather unsatisfied by what I heard there. I don't want to personally say that something is a moral argument instead of an ethical argument. I can usually tell when it's not a technical argument and that's the point at which I stop.

Now this business about "more emotional than moral," to me that question has no content. I cannot tell what the questioner has in mind because the terms to me--on the basis of how I see them used by people that one has reason to expect should be using them properly, I don't see the common pattern, and I just simply can't tell.

But the second part of the question, that is in what kind of forums should this be decided, it seems to me that we've got a system here that most of us agree is the one to use and that's the political process as it grinds around out there. And we toss up in there and we see what happens.

I most emphatically think that these are not issues to be decided by the proponents nor by the opposition and most singularly not by the technicians that are involved. But beyond that, I can't say much.

Dr. CALLAHAN: I think the forum is simply the political process very generally, making room for those who at least specifically identify themselves as trying to raise moral issues and press moral arguments. On the question of whether various statements are more emotional than ethical, that seems to me very much a matter of what's in the eye of the beholder. I would say that there are really--let me oversimplify--two competing moral traditions that I'm aware of in this country. One I would call the philosophical tradition; the other, the theological tradition.

In the philosophical tradition, I think the emphasis has been until maybe very recently on adequacy of arguments. The philosophers, at least those who are trained as moral philosophers, believe it is not their role to moralize for society, to lay down pronouncements, but rather to go about the business of deciding what counts as an adequate moral argument, what certain evidence one needs to bring to bear to make a moral case, the elucidation of commonly accepted ethical principles.

The theological tradition has by and large been more complex. And it seems to me that it has been an intention of many church groups of late to feel that it is their role to be a kind of moral witness and to take stands and thus to lay out their "here-I-stand" propositions with a great deal of emotional force and sometimes without attention to the niceties of argument which might satisfy professional philosophers or even some of their professional colleagues who are moral theologians.

Dr. ROSE: I'd like to comment on that because by strange circumstance Professor Abrahamson and I were participants in the debate in the Riverside Church last January that brought all this to a head; he, arguing one position and I, another. He is strongly associated with the National Council of Churches. (I am set to write some policy things for them on these kinds of things and our approach is quite different.)

I would differ with those who say that it is not the proper role of theologians to be moral or to pass moral judgments. What the hell is it for, if not for that?

But I find I hold very much with Lucretius in the first century who said, "We hold the earth in usufruct not in freehold." And I agree with Professor Abrahamson and those in the environmental movement that we must be very careful because there's only one earth and it is very fragile. And we have increasing power to destroy it in ways that we don't know.

Also, there are many other very complex questions about the rest of the world. If we do one thing, then the rest of the world looks at us and says, "Ah, they are doing this. Then that means something to them." For example, using nuclear power or not means that there will be or will not be a large demand on fossil fuels. And the old question of nuclear wastes looks very different if you look at it from the world point of view than from the national point of view.

The ethical debate as far as I recall it last January was that they objected to the incompleteness of the NCC statements. They said the work wasn't done or not finished, only partly done and pieces had been left out. With that, I agree.

Mr. GREEN: Dr. Skolnikoff, there's a question here that kind of criticizes your judgment as a political scientist and suggests that it may be attributable to your engineering background.

You are taken to task because you failed to provide in your talk a historical, social, and political perspective that would activate our cultural strength evident from previous populist opposition to new technology; for example, the muckraking attack of Ida Tarbell on the Standard Oil Trust. I'm not sure whether the questioner is suggesting that populist muckracking was good or bad; but, in any event, it says you didn't discuss it.

Dr. SKOLNIKOFF: That's true.

(Laughter)

Mr. GREEN: That's a very crisp answer.

(Laughter)

Dr. SKOLNIKOFF: I don't know how to give a crisp answer on this question.

(Laughter)

Let me just say one very brief thing which is that I by no means think that the pressures--if you want populist pressures for participation--are bad. The question is how do you have a society work when you really have a demand for participation on issues that are very hard--I use the word, accessible? They're very hard for everybody to participate in because they don't necessarily understand all of the high technology that's involved. That's not a new question. It is certainly an old question. And you can substitute any expert area for the problems throughout our history of attempting to deal with complicated issues. Really, the issue is more complexity than it is technology.

Mr. GREEN: Dr. Kasperson, a couple of related questions which I'm going to try to combine. Number one is purely informational. You're asked, what were the results of the Harris poll in 1975 and the Canadian poll, on nuclear energy.

Dr. KASPERSON: There's a lot of information there. The aggregate figure of support for nuclear energy depending upon how it's measured was high in both of these polls, lower in the more recent Gallop poll that came out during the summer and in the Canadian poll, the closer the reactor got to the individuals' homes.

Mr. GREEN: Then you are asked the basis for your statement that increased discussion of nuclear technology issues seems necessarily to increase opposition to nuclear energy. And, how can that be correct in view of the California referendum which turned out two-to-one in favor of nuclear in June, whereas it was two-to-one against nuclear the previous February in the polls?

Dr. KASPERSON: As I made the comment that I'm very suspicious of interpretations of what the Swedish elections suggested about nuclear energy, I have the same reservations as do many others with interpreting exactly what the California referendum tells us. Had not the three legislative bills been passed, it could have come out quite differently. Also, there are probably some mistakes in the tactics of the environmental movement there in the closing weeks.

But my statement on the relationship between knowledge rather than amount of discussion, although presumably they're related--not always, as we saw the other night here--we in our research in three countries have developed a test of the public's knowledge of nuclear technology.

We have formulated a scale of that knowledge. Then, holding a variety of things constant, we've looked at the relationship between knowledge and attitudes to nuclear energy. We find a consistent relationship across both men and women, and holding a variety of other factors constant, suggesting that the more knowledge one acquires about nuclear energy, at least the current kinds of knowledge that people are getting about nuclear energy, the greater the opposition. I'd be happy to share that with anyone who'd be interested.

Mr. COWAN: Could I add a comment? It seems to me that if increased discussion or knowledge indeed leads to increased opposition it's because it's part of the nature of the people who are having the increased discussions or increased knowledge.

The demand for participation, assuming that the technologists and the government people are already participating, are by and large from the people in our society who already have a relatively comfortable standard of living and who are among the better educated to start out with, what some people call the upper-middle-class American. And, the increased discussion leading to increased opposition does not necessarily follow if the increased discussion includes representation of those whose voices are not very often heard in this debate--of those, for example, from the labor movement or those to whom the issue of minimal standards of living and minimal survival in our central cities is much more important than the question--sometimes somewhat esoteric--about how much the risk is with one technology versus another.

Dr. KASPERSON: Just a quick response. I agree in part with that. I think it's very much connected with current information sources and with current levels of support, and that could change over time. But on the other hand, some of this may be noncognitive in the sense that the more one talks about nuclear energy the more, for very many people, you raise a set of fears connected with nuclear energy. Thus my point earlier on: that to document risk assessments on nuclear energy widely in the public may actually be to create apprehension at the same time.

Mr. GREEN: Bart, there's a question for you. It's pointed out that the President has more or less placed a ban on reprocessing nuclear fuel and exporting the technology. And you are asked whether in your professional opinion industry might have a basis for attacking that new policy on the ground that it was not preceded by an environmental impact statement.

Mr. COWAN: I have not read the President's statement, and I have not really considered the question of whether the National Environmental Policy Act is applicable to pronouncements of this type by the President.

It certainly did strike me when I heard the President's ban yesterday that that was one avenue that might be explored if indeed it is important to challenge it at such a highly visible way. I don't know. There are a lot of components about what you do when you go to challenge a pronouncement like that. For example, let's assume you're successful. What does that give you? That has to be factored into the equation.

Mr. GREEN: Dr. Rose, could you comment on the degree to which we have already performed the momentous nuclear waste burial experiment albeit with much less finesse through underground testing of nuclear weapons?

Dr. ROSE: Yes, I'll comment on that although I've not been a party to that kind of thing. It shows some illogicality in the way the debate has gone because if we imagine that the nuclear waste problem is insoluable, what have we been doing banging off these weapons down under the Nevada desert?

But if we believe that the nuclear weapons testing is reasonable, then what are we doing worrying about the waste disposal problem? There's some illogicality that needs to be considered because there's a great deal of plutonium and other things that are put down in a relatively haphazard way. I don't know the total amount, but I'm sure it's enough that by standards of nuclear waste disposal which we're talking about here, it would be vastly excessive.

Mr. GREEN: I have a question in the area of moral philosophy for Dr. Callahan. You listed a number of moral obligations. Is there not at least one more, that is an obligation on the part of the opponents of nuclear technology to familiarize themselves with information at least to the extent that they do not parrot untruths and distortions?

Dr. CALLAHAN: I would say yes and I would assume they would agree as well with that.

Mr. GREEN: A question for Dr. Abrahamson. Is it not true that you are espousing a populist ethic that the government is not allowed to restrain individuals and individuals can do no wrong?

Dr. ABRAHAMSON: It is not true. And if it's so interpreted, I'd better go back and review the draft of the paper. I can only speak for myself on this. I can't even pretend to speak for the environmental groups with which I'm closely associated.

But when I started in this game, I couldn't care iess about building or not building nuclear power plants. I had been trained in physics, spent a little time designing reactors; and during that

period either of training or in the corporate setting, it was never discussed--not a hint. No discussion, nothing at all about the hazards, of implications of reactors being there, of capital problems--I mean that whole series of things. It was just another job. I designed reactors, built thermostats, what's the difference.

And that's the baggage I carried with me when I first started looking at this thing. The thing that troubled me was the inconsistencies. Why was one thing written in one place and another written in another? Why was it that when we did a search of the biomedical library at Livermore on reactor effluents that the search came out empty--nothing? There was nothing.

Further, I fell under the influence of Barry Commoner who at that time had just written a book called "Science and Survival" where he argued vehemently that the scientist who spoke publicly as a scientist had an obligation to not state a position, not to take a position publicly, and to be objective, and so forth and so forth. Now I believed that for a long time.

Then it became clear that I couldn't any more in good conscience pretend that I didn't care because I found that I did care. And I had to decide for myself about this and what I decided long ago is that I want to see a good, clean fight. I want to see both sides of the issues adequately represented. I want the decision made on the merits and whenever it is, fine. I may not like it, but so what? That's the game. That's the system we're living in and that's one that I accept. I don't mean to espouse the point of view that was reflected in that question.

Now one other thing on this, and this is kind of a comment back to an earlier question: I'm troubled by the critics and the industry and the pro-nuclear people alike by failing to discipline those among their numbers, that is discipline themselves, who make statements in variance to what they know as individuals to be the facts. That troubles me a lot and I don't know how to handle it in some cases.

Mr. GREEN: I have a couple of related questions that I'm going to put to Dr. Abrahamson and Dr. Skolnikoff. These questions really relate to two things--the differences cited by Dr. Skolnikoff between the known risks of old technology and the unfamiliar risks of new technology; and secondly, the expressions of the lack of confidence in the ability of experts.

The questions really boil down to this: Can the nuclear controversy perhaps be explained in two ways--first, that in the past the risks of new technologies were not assessed but the principle of caveat emptor prevailed, but that now we do assess the risks of technology in advance and that it is this advance assessment process

that stimulates the controversy? And the second alternative or correlative explanation that is offered which is related to that is: Is it not possible the nuclear controversy exists with such intensity because there's built into the nuclear licensing process a first-rate opportunity to raise questions?

Dr. ABRAHAMSON. The first question is, to what extent is nuclear controversial because an attempt has been made to assess the risks and that some parallel was made about situations in the past where it wasn't? There's no question that the time that this issue arose embedded in things like discussions over DDT and food additives and SST, when large numbers of people began to appreciate that there had to be some effort made to assess the probable or possible implications of an activity prior to its inception, or at least prior to the the point that it expanded out of hand. That whole climate of things certainly played a part in the way the debate over atomic power evolved.

My personal view is that on most of the issues, including high-level waste management, it would not have been controversial had the responsible agencies and other persons been candid and forthright and responsive in the beginning. Look back at 1967-1968 when this began. The discussions began and it was clear within a few months that it wouldn't be like Ravenswood and Malibu and some of those other things that were just local skirmishes. It was clear that it was evolving into a national discussion.

What was the response, for example, of the Commission? In those days we called them "de-commissioners." The feeling was they elected to pretend that they didn't have to respond. I think one can't ignore this background in which the thing was embedded. But I think that much of the controversy resulted from a failure to provide information, a failure to respond rather than the converse.

Now the other thing, could you restate it? The controversy exsists because of a licensing opportunity?

Mr. GREEN: Right.

Dr. ABRAHAMSON: No, I don't think so. Again, I think a great deal of frustration--shall we say grass-roots frustration--with atomic power has come about because of the procedural and other difficulties for local individuals and groups to participate in these licensing things, not because of the licensing per se.

Dr. SKOLNIKOFF: Just let me comment very briefly. I think it is clearly true that we have never in the past assessed new technologies the way we are trying to do today--and not with very great

success today either. But today there's a very fundamental difference, a difference in degree which in fact is a difference in kind in today's world. And that is that the new technologies we're talking about do not by and large result from the kind of diffuse decision making that was always true in the past.

At the time of introduction of new technologies, very rarely was there an occasion for the kind of assessment or discussion or hearings that we are now becoming much more used to; and that was because of the nature of the technologies. Increasingly we are dealing with technologies that are global in their effects, that have major implications on the society, not just technological.

For example, one of the big issues of nuclear technology is the capital requirement. What is that going to do if you had anything like the original plans for nuclear reactors? Where are we going to be able to raise the capital to carry out those ambitious plans? That's something that affects the whole economy and has nothing to do with the kinds of issues we're talking about here.

That scale of the technology, that danger of the technology, it seems to me, is a rather fundamentally new situation, which is one of the reasons now that appropriately we are trying to understand earlier what its implications are. And there is a focus: the Federal government necessarily is involved at the beginning. Nuclear technology is one of the best examples--as a matter of fact, in some ways the only large-scale example, if you rule out agricultural technology--of public funds being used to develop commercial civilian technology.

This means that it's part of the political process in a way that was never true before at the time of introduction. Other technologies certainly came into the political process once in place through all kinds of implications but rarely at the time of introduction. And I think that's the major difference.

I would agree that the hearing process is not the only reason why these questions would be raised. Let's face it; nuclear technology is very dangerous and it's got all kinds of implications for health, for security, for nuclear war, that makes people very sensitive to what the issues are. I don't think you can get away from that.

Dr. ROSE: Regarding whether a lot of information about nuclear power has contributed to the debate, I think it has but not in the sense that there's been too much information. I think there's been an imbalance in how the information has been presented, especially about the alternatives to nuclear power and other sorts of things that can be done. It's led to an unbalanced debate. There was a lot of information about one particular aspect--say, the nuclear options--and very little about the fossil fuels, which happens to be one of my

whipping boys these days. The debate was bound to be unbalanced.

As to whether the licensing and legal process has been used for ends that had not been originally envisioned and for ends that are not always above board, I tend to disagree with those who say it hasn't been used. It has indeed. I know the case in Boston where the Pilgrim II reactor was shut down on a court order because of highly improper statements about the changing fuel rods; it was kept shut for about three months at a cost of nearly $25 million to the taxpayers of Massachusetts.

On the other side, I just heard the other day, a steam raiser--not a power plant but a steam raiser--discovered a loophole in the law that he could only burn low-sulphur coal. To make his precipitator work, which works better with high-sulphur coal, he found a loophole in the law, he could actually inject raw sulphur and burn it.

Mr. COWAN: I agree with Dr. Rose that the licensing process has been abused partly because of the built-in opportunity that it affords for delay in getting to and coming up with the decisions that need to be made as a result of that process. But I don't think that the licensing process explains away why we have the controversy. I don't think it's the cause of the controversy. It merely provides a first-rate opportunity, as I think the question said, for a public forum for furthering the controversial debate.

Mr. GREEN: Dr. Kasperson, this question is addressed to your suggestion that the powers that be not try to unduly accelerate the resolution of the nuclear waste problem. You are asked whether your proposal that we await a societal consensus does not in fact give the minority veto authority. And you are asked, moreover, in view of the asserted fact that the opposition to nuclear energy is the devil's own work, whether there is any hope that such a consensus will ever be achieved.

Dr. KASPERSON: I guess I should explain what I mean by a consensus. It's not that I expect that after we talk ourselves into exhaustion that we'll all come out with some universal agreement about what should be done. I think that there's a consensus that the issues have been fully stated and that the sides identified, and had a fair crack at, the process. And at least there's sufficient acquiescence in society to permit a policy to go forth by decision makers.

I think in fact that that kind of a process can take place. It will require an effort which is not ordinary but extraordinary. I'm not enamored with what I've seen proposed, so far as the same old processes that have been used on other kinds of issues, and I don't believe that that has provided adequate participation and adequate development of policy options. So I do think we need that change.

Mr. GREEN: Dr. Skolnikoff, what do you expect in terms of a solution to the radioactive waste management policy from the new Office of Science and Technology Policy in the White House?

Dr. SKOLNIKOFF: I would assume that that office, if it works properly, will have a substantial role not just inside the government, but, more importantly, the way the legislation is written now, outside the government as well in helping to clarify the debate, helping to make sure the information is out, and helping in fact to do what Mr. Kasperson just said--allow all views to be heard.

That does not necessarily mean that the decision that follows will be agreed to by everybody. I would hope the office would play a role in developing the kind of confidence and trust in the operation of the system that I think is absolutely essential to anyone's being willing to accept decisions that effect them adversely.

Mr. GREEN: We have waded through most of the questions. There are a couple of questions that I have consciously omitted because they were in the nature of speeches or statements rather than questions. And some very good questions that I have refrained from putting because it would probably take all day for even a single member of the panel to try to respond, let alone everyone who would want to get his oar in. The questions will, however, be delivered to the powers-that-be and I understand that they will at the very least appear or be dealt with in one way or another in the published proceedings.

I understand that the paper referred to earlier summarizing the goals paper is now available as you walk out. Dr. Campbell wants to say something before you leave.

Dr. CAMPBELL: A couple announcements about this afternoon's session. As you know, it's to be a summary session and we will hear from each of the session chairmen on what they believe has emerged either by way of consensus or disagreement within their panels. If the chairman of the working sessions wish to make a brief statement as to what occurred at their workshops, they may do so. I have received one such statement, and if there are others, I would be pleased to receive them.

Also, among the participants a group has gotten together and has prepared a statement about the Conference and the issues involved which they would like to make during the summary session. I've decided that I will permit that to be done, and they can do so orally. If there are other groups among the participants who would like a similar opportunity, they will be granted it.

Session was adjourned.

SESSION VI: SUMMARY OF CONFERENCE

MODERATOR: ALAN K. CAMPBELL, CONFERENCE CHAIRMAN

Presentation of summaries by:

LOIS SHARPE, Former Staff Coordinator, Environmental Department, League of Women Voters Education Fund

EDMOND ROVNER, Legislative Director, The National Governors' Conference

HAROLD P. GREEN, Professor of Law, National Law Center, George Washington University

With additional statements by:

TRUETT NETTLES, Environmentalists, Inc.

CATHERINE QUIGG, Pollution and Environmental Problems, Inc.

Mr. CAMPBELL: I have thus far received word from only one workshop that it wishes to report. If there are others who would like to report I hope they will let me know very soon.

I've also received only one statement to be made about the Conference from an organized group here, organized or unorganized as the case may be. If there are to be others I would like to know about that as well.

We will begin, as the program indicates, with summary reports from each of the sessions. The first part of the Conference had two sessions chaired by the same person who was not able to stay through today. He has therefore asked a member of the panel of those two sessions to give the report for him. You have already met Lois Sharpe because of her involvement earlier in those panels, so without further ado I will turn the microphone over to her for a summary of the two sessions on goals and criteria.

Summary of

SESSIONS II AND III

Ms. SHARPE: To remind you of the principal issues and concerns that surfaced during the two sessions on goals and criteria requires three processes: selection, condensation and some distillation.

Some subjects were given fuller treatment during the sessions, or snippets of attention a number of times; and these will merely be mentioned or passed over because they will appear in fuller development in the Conference proceedings.

This report is organized under five topics, not chronologically. These five are: risk acceptability, cost, goals, criteria, and information. One principal theme, basic to establishment of goals and criteria, was risk acceptability. Again and again this question of what-is-risk was raised from the floor, or was mentioned by a panelist. There was no indication that anyone at this Conference thinks that nuclear technology can be exploited at no risk at all; but disagreement about the risk and the risk ratio was implicit in many of the questions and responses.

The differences in risk calculation and perception are a driving force behind the public's insistence on a voice in discussion and decision making. Socio-psychological issues are critical; yet, as Paul Slovic, the first speaker of Session II, pointed out, factors of risk perception and risk acceptability have received remarkably little study to date. Nevertheless, recent results suggest that in principle it will be possible to answer the public's value and perceptions in a form that will be useful for decision making.

From his review of psychological determinants of perceived and acceptable risk, we all will, when we have the proceedings, be able to understand somewhat better why people have such difficulty making trade-offs between risks and benefits, and why very strong evidence is required to change people's perceptions.

While there are those who think a system should and must be designed that will make it possible to reach decisions without too much delay, the discussion also showed that acceptable risk may not be the same tomorrow as it is today, since attitudes and values change. Every decision, therefore, remains mutable. In the words of one panelist, you remember, "every decision must continually be propped up or struggled against."

It is the panel's opinion and agreement that the work of the sort that Paul Slovic reported is needed and should be supported, for the new answers it brought out are an important contribution to understanding and to the basic issue of credibility.

Turning next then to cost, cost entered into the goals discussion in a number of places. In the final paper of Session III, Gene Rochlin mentioned that utilities have no market incentives to absorb these waste management costs, so government action--that is, regulation--is necessary to accomplish desired goals.

Now this does not, in the opinion of members of the panel, however, imply that utilities do not realize that it's appropriate to bear these costs. The dollar costs of waste management measures were ranked low in priority by the subjects in the Battelle Institute study that Slovic described. We may assume that the respondents believed that higher costs would be justified if they improved short- or long-term demand.

Rochlin, in discussing criteria for waste disposal methods, also takes cost as a criterion of lesser importance, and uses it not as a technical determinant for defining an acceptable method, but as an elastic boundary condition to be satisfied. Once a method is selected according to considerations of risks, it is then to be examined to determine social and economic costs of operation.

Rochlin sees affordability as a flexible social and political decision. I'm glad to be able to report to you that there is one subject on which all the members of the panel and the four speakers were in complete agreement. Internalizing all costs for nuclear waste management received a fair share of attention in the meeting, and the unanimous support of the panel.

Centering indirectly now on goals, the second paper of Session II, you will remember, dealt with goals proposed by the NRC task force. Goals that are still subject to review through the usual agency review processes, but which were called to your attention as the guiding principles articulated by this NRC task force. The goals emerging from that group effort are not new; they were described by Bishop as a collection of some guiding principles, part technology and part common sense, to serve as a framework for an operating waste management cycle. As proposed, this report lays a heavy burden of proof upon the proponents of nuclear power.

Now I don't intend to go over this list again. Adoption of these or other goals will be, of course, only the first step in a process that will move on into development of the implementing regulations and the regulatory guides by which general aims can be transformed into specific requirements.

But goals, like campaign speeches, each taken by itself sounds reasonable. The problem arises when goals conflict, and when some are incompatible with others; as, for example, technical irreversibility versus retrievability. Now the real challenge lies in identifying the interrelationships and the conflicts in goals, not only as listed in any proposed document, but also as enunciated by different constituencies.

Mark Sharefkin's paper in Session III suggested other bases for the choice of alternative goals. He emphasized, first, economic efficiency; and, second, intertemporal fairness and equity; the latter including distributional and environmental equity. But clearly economic efficiency and intertemporal equity are incompatible, which leads to questions of trade-off.

Do we have adequate problematic understanding of the trade-offs between these two goals? he asks. If we had a better understanding, would we know what to do? A better understanding of effects would make it less difficult to make choices. Such understanding rests on means of producing consequences, he says, where there is a large population at risk.

Rochlin, in his Session III paper, suggested two criteria for organizing waste management options: technical irreversibility and site multiplicity. Of the two, Rochlin considers the first, irreversibility, the more important. Use of these criteria, he thinks, would best ensure that nuclear waste would be permanently isolated from the biosphere despite social and geological uncertainties or technical or judgmental errors. He proposed these two criteria as the best means of translating the goals of nuclear waste management, which he identifies as public health and safety, ethical and moral responsibility, obligations to the future, into a clear basis for open and conscious policy choice.

And lastly, a word about information. Rochlin emphasized the ethical necessity of providing the fullest possible information to future populations, but repeatedly through the panel discussion on both days the necessity of full and candid information and communication with the present population was discussed.

The purpose and significance of goals, criteria, standards, and regulations must be understood by the interested public if the credibility gap is to be closed. And only with this candor, and through processes compatible with our democratic system of government, will public agreement on goals and criteria for nuclear waste management be possible. Thank you.

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Mr. CAMPBELL. Thank you very much, Lois, for a succinct but complete summary of at least most of the points raised in those sessions as I heard them.

We now turn to a report on the fourth session of the Conference, which was related to organizational responsibilities and alternatives, and the chairman, as you know, of that session was Ed Rovner.

Summary of

SESSION IV

Mr. ROVNER: The topic for our panel was really a review of the institutions and the need through institutions to deal with the problems raised by radiation waste.

Mason Willrich, in his paper which I commend to all in some detail, first I think laid the foundation when he described the complex incidence of regulation of high-level waste and of low-level waste, and of controls at different points in the handling of these wastes, of each of them separately, and proposed what he considered to be a solution to the basic problems, which were as follows:

Number one: To get a rational single system for handling both high-level and TRU wastes by creating institutions that have the following criteria: management incentives...to separate management from regulatory and each from research and development...to clarify jurisdiction over the environmental question...and there must be a capacity for such institutions to adapt to further changes.

Number two: Create a radioactive waste public corporation with a board of directors on which there would be representation from the public, the industry, and the university community. It would sell stock on all U.S. waste facilities from temporary storage through final disposition, and would cover both commercial and military wastes.

The question was raised and not answered--not disposed of, let me put it that way--as to why such a public corporation would be more responsible to the public will than would a government agency. I think it's a problem worth exploring further.

The third point mentioned by Mason Willrich was his recommendation that we should select a single agency for all licensing, based on safety considerations; it would operate under a unified framework,

as would other agencies that have inspection and control responsibilities.

Fourth, ERDA should have the prime responsibility for all research, development, and demonstration.

Fifth, strengthen the international mechanisms to deal with seabed disposal, and so forth. And he made the point that this transition ought to be done as quickly as possible.

Bill Doub followed Mason Willrich's paper, and basically endorsed the idea of centralizing on the Federal level, in single agencies, these basic redefined responsibilities and reaggregated responsibilities. He pointed out that EPA is acquiring increasing jurisdiction not only over nuclear power but over state policy and programs. He noted that the Federal regulations and standards are woefully out of date, and the Federal agencies provide neither technical assistance nor funds for the states to expand their own capacity.

He pointed out that state regulatory powers are not very well used; the procedures vary from state to state and from subject to subject, including the policy regarding burial of the TRU waste. He favored Willrich's proposal and said that in his judgment the states want and should have a meaningful role in waste disposal, but they should not be individually permitted to exercise the plenary authority over them. The existing lack of a meaningful interface between Federal and state government is a problem both for the regulators and for industry, in his judgment.

A change in the regulatory process would result in some institutions yielding power; what he called for was an independent and self perpetuating institution, and pointed out that this would not be politically easy to bring off. He suggested there should be a reassertion of Federal jurisdiction over low-level waste, and would assign a different role to the states than the one that they now have.

He recommended that there be one Federal agency for regulations, and that there be a body of neutral experts to advise the government agencies and to evaluate their performance.

John Gray, one of our panelists picked because we thought that he could essentially be reflective of some of the industry perspectives, started out by noting that 11 per cent of our electricity today comes from nuclear generators, and by 1985 nuclear generators will account for about 35 per cent of our electricity. He too was attracted to Willrich's suggestion.

He said that ERDA is developing a weakness because of its inconsistent roles as a line agency and its research and development

responsibilities. He recommended that waste management should be handled outside of ERDA.

Ed Helminski, who was on the panel to represent some of the views of state government, started out by calling for a rethinking and an upgrading of the attitudes regarding Federal-state relations. He called for a radioactive materials policy as a precursor to one dealing with waste, and made the point that there is a short-term policy of how to handle these materials that have been produced by the military programs and by some of the commercial programs, which are now building up either at the military installations or around the commercial reactors, that must be dealt with in the short term. These would, for want of *any* better word, be called "waste," but that waste is a judgment in and of itself.

Waste is a *judgment* that the particular commodity on hand is either undesirable or is dangerous and has to be disposed of; and a changing technology may determine shifts in what we call waste and what we treat as waste, and that all radioactive material should be treated in accordance with a single policy and single approach, so that as the concept of what is waste changes, the same agency would be dealing with it.

He pointed out that governors seek a veto over energy facility determinations primarily as a guarantee that they will be given a role in the process, and that decisions will not be made to force one state to do what it does not want to do, while ignoring the desires of a neighboring state to perform that very function.

We then heard from Elizabeth Dodson Gray, who is representative, we believe, of the unorganized public. And summarizing her presentation is like trying to describe a painting. It was...I think one "gestalt," to use her own word, of the perception that women who are not involved in the industry or the regulation, women who are not demonstrators and so on, find themselves, or at least as they perceive themselves, even as we meet.

She noted that we live in a primarily male-dominated society. Over the years women have learned that medical treatment they accepted had long-term adverse affects, and that food and cosmetic additives were dangerous. She said that she once trusted the technologists but had lost faith, and subsequent revelations indicated that many of these treatments and many of these food supplements and so on were not only not in our best interests, but were adverse to the people who had been given them.

She said she no longer believed that new technology served her interests, and the loss of confidence extends to all technologies, including nuclear. Her message was: do not depend on policies which are themselves dependent on public confidence.

I think that was our judgment as to the message she was trying to give to people who are both regulators, industry, critics of existing policy, architects of alternative policies--there was a crisis of confidence in technology, which in fact may frustrate the effort to have rational debate.

Finally, John Andelin, who we asked to come because he represents that branch of the Federal government which is too often ignored, which is the Congress. He said that this Conference, in his judgment, should have been held 10 years ago. He said there have been too few decisions made and too few facts have been identified. Inaction is itself a decision and a policy.

He noted that our goal must be clear decisions, so that we can operate in reliance on them and review them periodically. He is attracted to a single decision-making authority, but specifically reserved judgment as to whether it ought to be confined to waste materials or all radioactive materials.

He said that the President, whoever he is in 1977, must lead in making comprehensive recommendations. The changes in who serves in the Congress and in the jurisdiction of the various committees makes it inappropriate to rely on the Congress to initiate comprehensive change. Congress is better suited to respond to proposals from the President, he said, and he urged that such proposals should ensure that there be a meaningful role for state governments.

All the participants in the panel agreed that the courts, although presently poorly equipped to do so, make policy today because there is a gap or a gross inequity in the regulatory mechanism.

Let me say what we did not cover--and which I apologize for; I do not think we had the time, and I think that it does require some study--the question of the nature of the institutions. What we discussed primarily, what this panel went through, was whether there should be more than one or a single one, whether it ought to be at the Federal level or the state level, whether low-level waste should be separated from high-level waste, and so on. But we did not discuss the nature of the institutions in the quest to make certain that appropriate parties, in interest to the resolution of any of the questions which come before such agencies or institutions, will have reasonable access to the institutions.

I think this is part of what Mrs. Gray was talking about, which is that there is no confidence, that there are disinterested, qualified parties who can put, if only for the moment, an end to the dispute.

All of us who are lawyers are accustomed to the idea that when the Supreme Court finally denies certiorari you pay the ticket and you

go home, the case is over. But we're not dealing with that kind of a problem. We have no forums now that can even resolve indefinitely into the future many of the questions, because people feel that they are not afforded a fair shot at that forum, that their views are not being articulated, that their views are not being researched, that their views are not being considered in the magnitude and the quality that they should be.

Until we can devise and utilize institutions which generate that kind of confidence, most of the people on the panel felt that we are going to be doomed to dates which have little hope of producing long-term, stable, and basically accepted final decisions. Thank you.

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Mr. CAMPBELL: Thank you very much, Ed. The final substantive session was related to the implications in this field, implications particularly in relation to their ethical and moral aspects; and Harold Green was chairman of that session and will give the summary of it.

Summary of

SESSION V

Mr. GREEN: Thank you, Dr. Campbell. I found what I think was an unexpectedly broad consensus. There is danger in my saying that, because I find the consensus not only in what was said, but also in what was not said; and beyond that, in what I infer would have been said if various people had actually spoken on particular subjects.

I think there was a consensus that the problem of implementing waste management goals involves major social, ethical and moral issues, which it is difficult to separate completely from technical issues; and this is primarily because of the problem of drawing inferences from uncertainty.

These moral, social, and ethical issues do involve fundamental issues. I think there probably was general agreement, or would have been, with Skolnikoff's point that although some of the alternative options can be discussed in quantitative terms, even the quantifications are bound up with emotional, economic, political, and personal aspects.

I think there was also a consensus that in discussing the alternatives no one can be completely disinterested, and even the most competent and objective experts cannot be expected to agree. The breadth of the area of likely disagreement among experts varies directly with the magnitude of the technological step, and the substantiality of the potential social consequences.

Secondly, I think there was a consensus that it is impossible to separate the social, moral, and ethical questions relating to nuclear waste management from the nuclear power question in general, and that question in turn cannot be separated from the ethic of growth.

Dr. Abrahamson argued that the driving force of growth in itself rests on an ethic; he seems to take issue with this ethic, although he does not explicitly embrace any particular alternative. But it is clear that Abrahamson believes that the ethic is one that ought to be debated.

Mr. Cowan, on the other hand, assailed Abrahamson's view, and seems to regard the growth ethic as an unquestionable premise on which public policy should be built.

I think Dr. Callahan provided us with some useful insights; he pointed out that growth is something that we may desire, but which we do not really need; therefore, it is debatable. But he then went on to say that in an imperfect world ethics must be developed in the context of what is likely and not what we wish would be the case; and that since it appears that the growth ethic is going to persist our ethical standards should be tailored to the apparent certainty of growth.

Third, there seems to be a general consensus that although the waste management problem has some distinctive characteristics, it is not totally unique. One respect in which it may be unique is that we have known of the adverse consequences of radioactive waste from the very beginning of our involvement in the problem.

Kasperson suggests that the problem, the social, moral, and ethical issues of radioactive waste management would suffer the same degree of public disinterest as analogous technological risks in other areas, had not the more dramatic issues of reactor safety been present as stimuli for public concern. In Kasperson's view, waste management is merely one of the battlegrounds in the war between the environmentalists and nuclear power.

Dr. Kasperson also performed a useful service in reminding us that the risks as perceived by the public are more important than the risks as understood by the experts.

With respect to the moral, ethical, and social issues involved

in particular options, there did not seem to be very much in the way of a consensus. With respect to the question of long-term containment of radioactive wastes, Abrahamson points out that the technocrat experts tend to accept some degree of pollution and some degree of injury to society, particularly where the injury is inflicted upon a random population on a statistical basis, where cost-benefit analysis indicates that such a level of injury or insult is economically optimal.

Closely related is Abrahamson's assertion that experts perceive that natural resources are becoming increasingly productive, thereby diminishing the perceived need for conservation of natural resources. In summary, Abrahamson argues that we are increasingly willing to accept marginal gains in present welfare in exchange for larger marginal losses in future welfare.

Closely related to this is the issue of retrievability or non-retrievability of nuclear wastes. A present decision with respect to this is necessary; and the quality of the decision, the nature of the decision depends upon society's view of its responsibilties to future generations, as well as society's view as to the potential ability that future generations will have to fend for themselves.

Kasperson points out that nuclear technologists tend to emphasize short-term safety considerations, while much of the public has embraced the ethic that the present generation is the steward over the earth for the benefit of future generations. It's kind of interesting, incidentally, that nobody pointed out that that stewardship ethic is explicitly adopted in the National Environmental Policy Act.

Dr. Callahan, I think, made a tremendous contribution to our discussion when he attempted to define what our responsibility is to future generations. He said in effect that we have a responsibility to future generations, but not too much of a responsibility. And we do have a responsibility not to leave future generations any worse off than we are, and that we have a responsibility not to do irreversible harm.

He comes out by saying that we don't need any eternal solution to the problem that will last for all generations; it's enough that we provide an answer that will last for two or three generations, and that we can have confidence that future generations will be as smart as we are, and will be able to figure out what to do about future generations in the future.

With respect to long-term social or government institutions, there is a question: can we really ensure their existence? How can we create an institution, for example, that will last for twice as long as the period of time that has elapsed since Columbus discovered the new world?

Skolnikoff has some skepticism about the permanence of effective institutions. He points out that they tend to become captives of their constituency, and that the focus of their concerns tends to narrow. He tells us various ways that we might deal with this, but I don't think he came up with a solution in perpetuity.

Another question that has been raised, relates to the high degree of omniscience and infallibility that is required to construct a totally engineered system, free of error, faults, or failure. Does an institution of that kind require, as Abrahamson suggested, the establishment of a specialized, elite cadre, or a new priesthood of waste managers? And do we want that, in a democratic society?

Abrahamson also raised the question as to where will radioactive wastes be put temporarily, permanently, or in transit. Putting it another way, will the people for example of the state of Michigan be called upon to bear the burdens of perpetual maintenance of waste in order to give the people of, for example, New England an adequate supply of electricity?

I thought again Dr. Callahan performed a distinguished service when he told us that that's not a unique problem. The same problem exists with respect to old people, insane people, cemeteries, and other kinds of what he characterized very bluntly as "social waste."

Turning to the question of political institutions for the implementation of the radioactive waste management goals, I think that there was a unanimous agreement on the part of the entire panel that this is a real problem; there is a real problem of acceptability, a real problem of selling a waste management program to the public. And the discussion on the assumption that there was such a problem; that is, where did it come from in the past; and secondly, what should we do about it in the future.

There was general agreement that implementation of these goals is dependent upon public confidence in the experts who devise the implementation measures, and that openness and candor on the part of the experts was dictated. Dr. Rose, interestingly, seemed at least moderately to dissent from that; he pointed out that society could become hostage to the vagaries of a single untruthful scientist.

Beyond that, there were some shades of opinion, and I can't characterize this as a consensus. Abrahamson points out that there are serious problems of credibility with respect to the nuclear waste problem in the past; that the establishment has been grossly over-optimistic. And he pointed out, in what I thought was a rather damning comment, that public confidence must be preceded by competence.

Skolnikoff pointed out that there had been past problems with the credibility of atomic energy experts, although he did not

explicitly state that he thinks the problem has extended into the present era. He did, however, point out that there still exists a distrust of nuclear experts.

Kasperson told us that present institutions relevant to this question do not have credibility. Cowan argued that openness and candor will not in themselves restore confidence. He seems to place a large measure of the blame on those who condemn nuclear technology, even after it has been conclusively demonstrated that their condemnation has been shown to be without merit.

Callahan points out that the question of truth and responsibility lies primarily in the eye of the beholder. In any event, Skolnikoff, unconcerned about who is responsible for the mess we are now in, did give us a fairly detailed blueprint for linkage between the experts and the public in the implementation of waste management goals.

He tells us that, number one, the process must be open and candid, and that this open and candid discussion must start at very early points. Both Kasperson and Skolnikoff, although both of them of course enforce that view, were quick to point out that such open and candid discussion may in fact lead to increased opposition to the technology. But it seems, however, to be implicit that that kind of open and candid discussion will, in their view, over the long run, increase public acceptance.

I think there was a general agreement, subject only perhaps to the caveats of Cowan, that it's important to involve other institutions, other government institutions, educational institutions, research institutions, environmental institutions, in the process of decision making, and that the government should assume a responsibility for funding from diverse sources, diverse agencies, and hopefully private agencies as well--funding for the involvement of multiple institutions.

There seemed to be almost a general agreement that the government ought to fund major policy analyses, like policy analysis of the Rasmussen report, to test its validity.

I don't think anyone disagreed with the notion that a public forum such as this one is extremely useful, desirable, and ought to be repeated many times over. There was some discussion as to whether we need a new kind of government agency to control the waste management program. I think there probably was a consensus that we do.

To the question, how do we keep that from becoming a captive of the industry? Skolnikoff suggested that organizations like GAO, Office of Technology Assessment, Congressional Research Service, the Congressional Budget Office, may have an important role to play.

He suggested also that new agencies, new institutions be established for, as he put it, "advocacy and objectivity." Rose seemingly dissented from the part about advocacy, saying that he had some question as to whether advocacy would work where there really is no judge to keep the advocacy going.

Finally, Skolnikoff's sixth point dealt with the necessity for bringing industry along in this new structure.

I guess the final thing that is worth noting was Kasperson's point that although it's possible, by pushing one or more buttons, to dramatically accelerate the development of waste management technology and risk assessment, to compress that development within a period of relatively few years, there is really no button that you can push to speed up the process by which public opinion organizes a consensus that a desired technological program ought to be adopted.

He points out that there is a need for time, for balancing the considerations for the various groups talking with each other, arguing with each other, jawboning, compromising, negotiating, to try to work things out; and he strenuously urges the establishment not to try to, as he puts it, overwhelm societal reservations and conflicts by putting out, for example, an Environmental Impact Statement that alleges that there are essentially zero risks in radioactive waste management.

Such an effort to overwhelm, he tells us, will only increase rancor and will detract from an authoritative resolution of the problem. Instead, he urges that we work strenuously to internalize the existing conflicts within existing and new institutions.

And then finally, the last important comment that I think emerged was that offered by Dr. Rose, who reminds us as to the vital necessity for obtaining input as to the needs and positions of other nations. The nuclear waste management program is not one indigenous to the United States; it's one that cuts across the entire international spectrum, and although we did not deal with that in the formal program here, I think it's an aspect that we ought to keep in mind.

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Mr. CAMPBELL: Thank you very much, Harold. I now have the brief three-paragraph report from one of the workshop sessions. I've been asked to read it to you, and I will; if there are any other workshop session reports I hope that they will so be indicated when I finish reading this brief statement.

Summary of

WORKSHOP ON RISK ANALYSIS

This is the summary of the workshop on elements of risk analysis in nuclear waste management. The scope of the workshop was limited to consideration of the need for standards dealing specifically with risk from accidents or incidents as opposed to controlled releases.

A brief review of current standards addressing risk, regardless of the promulgating group, was presented. This was followed by a discussion of the suitability and usefulness of such standards, particularly as they would relate to waste management efforts.

No effort was made to discuss the risk acceptability issues, nor the quantification of risk. Two general conclusions could be drawn from the workshop, in the opinion of the panelists and participants.

There was a general agreement that risk-oriented standards, criteria, objectives, and the like would be useful; however, concern was expressed that the expression of such standards in probability terms for some applications such as geological disposal may not be appropriate due to the uncertainties involved, and the tendency for calculated values being given inordinate weight.

In the second conclusion, there was a great amount of discussion regarding the capability to quantify long-term risk with any degree of certainty. The workshop apparently had some difficultly reaching conclusions.

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Are there other workshop reports? If not, I would like to request Truett Nettles of the Environmentalists, Inc. of South Carolina to make a statement for a group of environmentalists here who have been meeting together during the course of this meeting. Mr. Nettles.

Remarks of

TRUETT NETTLES, Environmentalists, Inc.

Mr. NETTLES: Thank you very much. We've had a sort of an informal skeptic caucus meeting in the evenings. We have formulated a policy position, and we have also prepared a statement on this Conference and some recommendations for future conferences and future mechanisms for involving the public in all the problems associated with nuclear energy.

I would like to read first our policy position:

Environmentalists, Inc., of South Carolina, is joined by the undersigned individuals and organizations in recommending that ERDA, NRC and other responsible Federal agencies adopt the following proposals for management of spent nuclear fuel waste:

1) Present nuclear energy implementation priorities must be reversed; solutions to waste management programs must be found first. These solutions should be the basic determining factor in all production and operational decisions.

2) Plans should be initiated for the building of facilities designed for the storage of spent nuclear fuel in its own fuel rods. This is one of the alternatives for managing waste discussed in ERDA 76-43, entitled, "Alternatives for Managing Waste from Reactors and Post-Fission Operations in the LWR Fuel Cycle."

3) The primary criterion for solidification of liquid waste from past operations should be zero release of radioactive elements to the environment.

Now, many of the individuals who signed this policy statement represent citizen groups from around the country. Obviously, since this policy statement was formulated during the Conference, the respective organizations have not had an opportunity to formally adopt this statement. So it should be remembered that this policy or statement of position by those of us who signed it is a statement of principle.

There are copies of this available from the press room. Just to let you know where some of the groups are that signed this: my own group from South Carolina; also Public Citizen Congress Watch--that's the Nader organization in Washington; we had Concern, Incorporated from Detroit, Michigan; the League Against Nuclear Dangers from Stevens Point, Wisconsin; Energy Probe from Toronto; the Audubon Society of New Hampshire; the Lake Michigan Federation from here in Chicago; the Environmental Policy Center in Washington; a group called Four Laws on the Board; and the Coalition for Safe Power, both of Portland; the Coalition for Safe Electric Power from Rocky River, Ohio; and other individuals.

If there are other individuals who have not signed this statement

and would like to do so, Cynthia Sampson will be here after the adjournment of the Conference, and those who wish to sign the statement may do so.

Miss Evelyn Stebbins, representing the Coalition for Safe Electric Power from Rocky River, Ohio, has drafted, with the support of those of us who signed this document, a statement on this Conference and some recommendations for future activities; and I would like to read Ms. Stebbins' comments at this time:

The thought behind the holding of this Conference--that is to allow public comment on the nuclear waste management program--is to be commended.

The announced purpose of this Conference as set forth in the program was to provide a public forum in which to identify and to discuss the legal, institutional, social, environmental, and other public policy issues relating to nuclear waste management; to encourage public input in establishing a national nuclear waste management program; to improve public understanding of the implications of the technical alternatives; and to provide for an exchange of viewpoints strongly focused on the issue which should be considered in the environmental impact statements which will be solicited to assist Federal decision making in nuclear waste management.

Well now this is all very good; unfortunately, many of us, and those of us who have signed this statement, feel that these purposes announced at the beginning of the Conference have not been adequately met. Some of the reasons we feel this way I would like to tell you right now.

This Conference is held in Chicago, for three days during the middle of the week. There are maybe two or three of these citizens groups who have paid staff. The rest of us who are here are either unemployed or self-employed and were able to get away. I'm self-employed and sacrificed my own working time to come here and do this, and it's very difficult to get citizen input into a Conference like this, when you hold it in the middle of the week in a place like Chicago.

Now I understand a national conference has to be somewhere, and it just so happens that I had to travel a long distance, but I think consideration should be given to the time and the place of future conferences such as this.

Obviously no matter how well constructed or constituted a panel is, it could never reflect all the various attitudes of the various segments of the public who are interested in this problem. Some of the citizens who were providing some of the most active opposition

to all the phases of the nuclear energy in our country, these sort of people, if they are in fact the ones who are slowing down the industry or whatever, these are the people whose concerns need to be addressed by this Conference, and many of these views were not specifically expounded by the composition of all the panels.

There has been little opportunity for a really public forum to allow the expression of views, nor has there been any attempt to attain the viewpoints of the public involved in the Conference other than the questions, though of course the questions were good. And also the workshops were very good; this provided one of the few places where we were allowed to really get into an open and flowing dialogue with technical people, industry people, environmental people, and whoever else happened to be in the workshop.

We thought the workshops were good, and the social hour was pretty good too; that's where I had some of my best exchanges of information; I guess, when people have a drink they talk better.

We understand that there was in the budget for this Conference, funding available to supplement or reimburse citizens groups. It's regrettable that the availability of this funding was not communicated to different citizens groups around the country. I think we would have had a much stronger representation of citizens groups if they had the money.

We fully recognize that we already have serious nuclear waste problems here and now, today; and whether you're opposed in general to nuclear energy or whether you think it's the absolute and only answer to our nation's needs, everyone agrees that the waste management is something that we need to discuss and come to a satisfactory conclusion on.

The solution to the problem of high-level defense waste and commercial waste, however, cannot be reached in a vacuum. The total problems of these high-level wastes, and problems with tailings and problems with low-level wastes, and problems with accidential releases, and continuing production of nuclear waste, all of these must be fully and completely integrated into the final decision in order to assure the full integrity of the waste management system, in which integrity is absolutely necessary.

One of the necessary ingredients in a successful waste management program will be public participation, as we heard repeatedly in the Conference. A public participation program cannot be one, however, in which the public is invited to sit in and listen to a series of presentations; no matter how great the various papers are, and no matter how articulate and erudite the various speakers, this is not going to satisfy people who are concerned, to just sit out there and

listen to more information which they may or may not understand or appreciate.

We would like to recommend for future such conferences, hoping that they wll be held, the following things to be implemented in order to assure better public participation in this very important decision that this nation faces in choosing the best possible solution to the nuclear waste management program:

There should be, of course, full availability of all information to interested parties in an easily accessible place. My organization has been involved in different areas of the nuclear energy question for a long time, and we have developed some expertise in locating and ferreting out from the various agencies and institutions information; but even for those of us who have experience with it, it's difficult. There is a problem on the part of the public with getting concise, understandable information.

We think it would be a very good idea to hold smaller, regional meetings in the future. I think you would attract a much greater public participation, and make it easier for them to travel to, and get away from their jobs to participate in this kind of conference.

Regional citizen advisory panels should be established for program planning purposes. A good example of the possibility of this is, I believe, ERDA sponsoring this Regional Energy Conference in Boston, which is going to be held at the end of November. Citizens have been involved in the planning of that conference, and I think they'll find that the citizens get a lot more out of it when they can help plan it, and have a lot more input to it at that level.

The most important thing I have to say about the future is funding. It's absolutely absurd to expect to get informed questions from environmentalists and other concerned citizens when we have to come here on a skateboard and everybody else is paid and their expenses are covered. We have a very difficult time in our efforts, recruiting and reimbursing technical assistance and legal assistance, and just covering the cost of our publications and our communications and things like that.

I resent it, and I know a lot of people who are working along in this thing also resent it, when we hear complaints that our questions are not informed, or that our sentiments are not sophisticated enough, or that we don't understand what's going on.

Well, how can you expect us to? We can't really afford to meet you halfway. We'd like to; it's silly to expect groups like ours to come across in a real sophisticated fashion when we simply do not have the financial resources to do it.

We have some very great apprehensions for the future. Will we

get all the facts--not just the good ones, but all the facts--trusting that we'll be able to make the decision about which facts are good and which facts are bad? And will the public be listened to and be responded to? And what are going to be the criteria in this decision making, and who is going to make the decision?

We hope the decision making will be an open public process, and the ultimate decision reached will be one that will satisfy as many people as possible. I hope that the sponsoring agencies take these remarks that I've made this afternoon in the manner in which they were intended, and that is constructive; they're criticisms of the Conference, and expressions of hope for the future, but they're offered in a constructive way.

I think this Conference has been a very good step in the right direction. It's a first step; it may be 20 years late, but it's a good step in the right direction. The many problems that are facing us, as we deal with all the different ramifications of nuclear energy, provide a new opportunity for us as a society to develop better and more appropriate decision-making processes.

The gestalt referred to yesterday by Miss Gray requires new levels and new mechanisms for public involvement. This is something which even in our democracy we have not seen before.

So I hope that this Conference can be a beginning of a new experiment in public involvement in decision making in our society, and beyond that, bring in people on the national level and on the international level, so that we can work together to answer the crucial questions that face us in these problems that we've talked about in the last three days. Thank you very much.

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Mr. CAMPBELL: Thank you very much, Mr. Nettles. I have not received any other indications that there are any other statements... yes, please, would you like to come around where there are steps.

Remarks of

CATHERINE QUIGG, Pollution and Environmental Problems, Inc.

Ms. Quigg: I'm Catherine Quigg. I'm with a Chicago-area environmental group, Pollution and Environmental Problems, Inc. I just

have a brief statement I'd like to make about the Conference.

How do you open to public debate and participation an issue which has never been fully and adequately discussed in any stage of its development? Are we to believe that suddenly the nuclear establishment will do an about-face and tell the whole truth about the end of the nuclear fuel cycle, when it hasn't done this about the beginning or the middle of the cycle?

I would also ask, how do you solicit public participation on what you must acknowledge is thus far an unsolved problem: the long-term burial of radioactive waste? The emperor has no clothes. How do you decide betwen the unacceptable alternatives presented in the Battelle report for managing existing commercial high-level radioactive waste? Liquid storage, high probability for dispersion; conversion to cement technology has not been demonstrated; shale fracturing technology has not been demonstrated; shale cement technology has not been demonstrated; calcination technology has not been demonstrated; aqueous silicate technology has not been demonstrated; conversion to glass technology has not been demonstrated; salt cake technology has not been demonstrated.

It would seem that a technology that produces the toxic, non-disposable product should be stopped at the front end. Strangely, participants in this Conference were precluded from mentioning this obvious deduction. Are we going to be involved in garbage disposal but not in garbage production decisions?

In conclusion, I would like to participate in your public decision making forums; but you have given me no reasonable choices. I suggest you go back to work. Thank you.

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Mr. CAMPBELL: Thank you very much. I would like to point out something which I'm sure most of you know. There is a notice out, published in the Federal Register, inviting statements about the Environmental Impact Statement--the generic statement--before that statement is issued. This permits becoming involved in the process before a product has been produced by it. Such comments are due by November 15th, and should be presented to the appropriate officials. And the person directly involved is Mr. W. H. Pennington, who is Director of the Office of NEPA Coordination; he is present at the Conference, and has been here throughout it.

I know many of you have seen this notice in the Federal Register, but if you have not, it is available, and it does invite participation before the statement itself is issued, even in summary or in draft form.

Now are there other statements that people wish to make, or questions that they would like to ask? If not, allow me about three minutes to suggest to you that we have participated in an effort here to open the policy-making process; whether it is sufficiently open is a matter, obviously, of debate. Nonetheless, it has been more open than has been generally true in Federal policy-making, and certainly more than has been generally true in the nuclear field.

Whether the art of policy-making has been advanced by our effort here I am not certain; but I suggest it be kept in mind there is a distinction between substantive and process matters, and that the substantive issues, it seems to me, have been presented in depth and with clarity by the various and sundry panels.

Process is a more complicated question, because the concern for process often has hidden within it underlying substantive policy issues, and therefore should not be considered as neutral. After all, an advocate of states' rights is normally advocating states' rights not because he's a firm believer in that as a concept, but rather because he believes that states' rights will produce a policy outcome which is more satisfactory to him than would be some other way of making policy. And there is that element in all process concerns, and I think we should accept it and understand it.

Further, processes are often thought of as educational rather than as participation in policy making. It is believed that if the public understood they would accept certain policies; and therefore, what is needed, it is argued, is an education process, rather than a policy-making participation process. There is also the fact that in the process new information might well be presented that people had not known before; and in that sense process can make a substantive contribution to decision making.

Finally, there is the issue of whether one accepts in such processes the display of what could be considered intuitive or nonobjective knowledge, feelings and the like. It seems to me in a democratic society it is inevitable that one must, and it is therefore terribly important that policy-makers who see themselves as rational analysts be aware that there are other ways by which people learn things and come to have views, and that they must be as responsive to those as they are to knowledge that is produced by the more traditional, rational processes.

In relation to this specific Conference, I would point out again that there was a limitation on the subject matter by restricting it to the waste issue, and there has been a good deal of criticism of that, and I respect that criticism. I will, however, repeat what I said at the beginning of the Conference, in order to concentrate attention, to focus attention, and perhaps to advance understanding, that the restriction served a useful purpose.

I would, however, add--as is probably unnecessary--that the whole system, of which disposing of nuclear waste is but a part, must be looked at in its entirety. I am concerned that our institutions do not seem capable of doing that.

If I may just take a minute to try to illustrate what I mean, because I think it is terribly important: Obviously underlying the issues discussed here is the question of the need for additional energy, and where that energy is going to come from. And that is related to the importance of growth in a society. And I was pleased that this issue did emerge at our last session this morning.

However, even then it was not raised, it seemed to me, in as sophisticated a way as it might have been. For example, growth relates not only to the question of how much in total a society has, but to how that society distributes what it has. And if one believes there should be some redistribution of wealth and income in our society --as I'm sure a good number of people here do, in terms of what I know about their backgrounds and interests--then the question becomes: how does growth relate to the distribution issue?

I think it can be demonstrated that redistribution has occurred in this society only from the growth increment; that there has been a political inability to redistribute what people already have. I therefore suggest that in asking the question of whether there ought to be growth, one should not forget that it relates to the very nature of the society. Unless the political resistance to redistribute can be overcome, only growth will permit any redistribution to occur.

So within this context, the energy issue, and behind that the questions of safety and waste management, take on general importance that I think may get lost in the process of preparing environmental impact statements, and the other orderly processes gone through. The issues often become so narrowed that the most important issues are frequently not considered.

Finally, in relation to this specific Conference, just two or three words. Can agreement be reached on technical issues? I think that the reason it is difficult to answer that question is because we have difficulty defining what is technical, and what is not.

For example, is it a technical issue that an organizational system which will be subject to great pressures must remain in place over a very long period of time? It seems to me it is not a technical issue, and yet it is terribly important to the technical decisions that will have to be made. Decisions cannot be divided along a technical and nontechnical dividing line. The interactions and interrelationships must be considered together. And I believe this need was demonstrated by the kinds of debate and discussions which took place here.

In relation to the economics of waste management, I was surprised that very little attention was given to cost. Apparently, that is because the alternatives being considered in the waste management field possess costs relative to total cost with sufficiently small variations to permit their being ignored. This is one of the few areas where the cost-benefit type of analytical tool, so beloved by the economists, is relatively unimportant.

On the political side, I heard civil rights issues raised, I heard issues about organizational behavior, and about bureaucratic behavior. I heard concern about the relative strength of different interest groups in the political process. It seems to me that on the political side we need to recognize that there is a validity and an integrity about that process which is as significant and important as economic processes or technological processes.

Finally, I think the ethical and value issues were well presented, and they cover a very wide range of values indeed, and hopefully the technical people were listening carefully to these presentations because they cannot be quantified, and there is a tendency--and I blame the social scientists here as much as the natural scientists--to assume if you can't quantify it, ignore it.

Finally, I would add that in the organization of the Conference, in the invitations that went to those who participated, and in the subject matter to be covered, I found on the part of the public servants who were involved an unusual openness, a belief that all issues should be discussed. In fact, on occasion it was the chairmen who insisted on orderly procedures, the requiring of written questions and so forth, rather than those who were responsible for organizing the Conference itself.

The organizers also demonstrated that characteristic of public servants demanded by Louis Brownlow; they should possess a passion for anonymity. It seems to me that passion was appropriately exercised here by those who were behind the scenes running the Conference.

At any rate, I was pleased about their openness and willingness to have full participation in the Conference, and I simply report this as an outsider who had some questions in the beginning about whether that would be the case. And I close by congratulating all of of you for your patience and forbearance. The Conference is ended.

Conference adjourned.

LUNCHEON SESSION, Wednesday, October 27

SPEAKER: CONGRESSMAN JOHN B. ANDERSON OF ILLINOIS, RANKING HOUSE MINORITY MEMBER, JOINT COMMITTEE ON ATOMIC ENERGY

Mr. CAMPBELL: It is my pleasure to introduce Congressman John Anderson of Illinois...He is the House of Representatives' ranking minority member of the Joint Committee on Atomic Energy, the third ranking Republican in the House, and the chairman of the House Republican Conference.

I note in glancing at a bit of his background, that as an undergraduate he majored in political science at the University of Illinois, where he had a very fine scholarship record indeed, being elected to Phi Beta Kappa...He went on and received his law degree at the University of Illinois and his Masters of Law degree from Harvard.

He has been in public service before, running for elected office and having been a foreign service officer in Berlin from 1952 to '55. He then returned to Rockford, Illinois to practice law in 1955. He was elected as a state's attorney for Winnebago County and remained in that position until being elected to Congress in 1960.

Since being elected to Congress he has, from the point of view of an academic, been engaging in unfair competition with us, because he has written two books: "Between Two Worlds--A Congressman's Choice" which was published in 1970, and "Vision and Betrayal in America," published in 1975.

We appreciate, Congressman Anderson, your taking the time in what I believe is a relatively busy season for those in your profession to come and spend this luncheon period with us.

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Congressman ANDERSON: Mr. Chairman, you have just referred to the fact that this is a somewhat busy season of the year for people in my profession. I think it is fair to say that at this time of year politicians like myself are not usually overly endowed with undue modesty and self-abasement.

Notwithstanding that fact, I have to confess that as I look out in this audience and see some old friends from my association with the Joint Committee on Atomic Energy, I have the feeling that there are more than several in this group who could address themselves to

this topic of nuclear waste management as it impacts on the sphere of public policy making with far greater expertise and knowledge than I.

I'm delighted that we have this opportunity to bring together representatives of various agencies of our Federal government, those of you from the private sector and those who are especially interested in environmental questions, and to try, out of that confluence of forces, to give some thought to the very important problem of what we do and how we evolve policy in this area.

Members of the Joint Committee are sometimes a little sensitive to the fact that the publicity on nuclear energy seems to be focused pretty much in a single direction. I make reference to one specific example which occurred in this last session of Congress. When following the celebrated resignation of three engineers from the General Electric Corporation, and a young man from a middle-level management position within the Nuclear Regulatory Commission, Chairman Pastore of Rhode Island undertook, and I think quite properly so, to conduct public hearings on the sources of their disaffection and dissatisfaction with the management of the nuclear power program.

We met in a rather cavernous meeting hall, a room that some of you may have been in in Washington, the Senate Caucus Room in the Old Senate Office Building, and there, under the very hot klieg lights for for about a day and a half, we listened to the four principals to whom I have just referred, testify in opposition to the nuclear power program. Following their testimony, we heard from what we thought were some very distinguished representatives of the other camp, the other side of the argument. These were people, who by virtue of their training and expertise and academic background, were equally entitled to be heard.

The difference was, as the chairman lamented, that we felt very lonely in that cavernous hearing room as the second part of the hearing began. The klieg lights had been turned off, the television cameras had left, and the print media had departed as well. Much of the news that was made on that occasion focused pretty much on the complaints, and there was very little substantive news to try to balance the argument.

I would hope that out of this meeting this week, with any confessions of failure that may come, would come an agreement among all parties that we would try to look at this issue from a balanced perspective. It is important to have such expectations because we live in a particular era in the history of our country when we are seeing the conjunction of two very important trends--both of which are, in my opinion and humble judgment, adverse to some of the decisions that we have to make.

Let me illustrate. In the first place, there is the well-known

public dissatisfaction with government itself. As a representative of the Federal government, whenever I have been greeted by audiences in a friendly fashion, I'm quite relieved because it's said that there are three little white lies that are the most commonly circulated white lies. The first of these is, "I gave at the office." The second is, "Your check is in the mail." And the third is, "I'm from the Federal government and I'm here to help you." There aren't too many people that are willing to accept the latter explanation any more without a certain amount of convincing.

The second trend that we have seen is, as many others have described it, a revolt against technology, a growing disbelief that technology can solve all of our problems. The story has been told and retold perhaps too many times already, but for the benefit of the small number who may not have heard it, nothing comes to my mind quite as much as the Boswell and Johnson story. Boswell and Dr. Johnson were on a walk together and Boswell was complaining to his companion about the fact that Berkley's theory of the nonexistence of matter was, of course, errant nonsense. "At the same time," he said, "you've got to admit that Berkley's theory is very hard to dismiss." As he made that observation they chanced to be passing a very large stone and Dr. Johnson kicked the stone sharply--indeed with such vehemence that he recoiled with some pain. And as he did he said, "I dismiss it thus!"

The anecdote emphasizes the obvious point to me that we cannot indulge as policy makers today in the same luxury that Dr. Johnson enjoyed. We cannot kick, we cannot beat over the head, we cannot lightly dismiss the forces of public opinion that have been arrayed against the further development of this alternative source of energy.

I have read the admonition and the injunction contained in your program that this is not a meeting which is designed to discuss the advisability or the non-advisability of continuing a nuclear power program. That is accepted as a given fact. But, and you will pardon here the obviously personal reference, whenever I think how this question impacts on the sphere of public policy and how it is made, I am brought into sharp contact with the reality and with the fact that I am Exhibit A.

In the political arena today, people are choosing one candidate over another, at least to some degree, on the basis of the stand they take on specific issues. The young man who is contesting me for the seat that I hope to continue to occupy in the 95th Congress is in the race because of his very sincere belief that we should not have nuclear power, and that there ought to be, at the least, a total moratorium on the construction of nuclear power plants. In our only face-to-face meeting to date, that was the sole topic of discussion. So, I have some personal acquaintance with this matter and how it is affecting this whole sphere of the manner in which we make public policy.

In spite of the well publicized complaints of many, I would point out that there have been numerous hearings on the subject of nuclear waste management during the years that I have been a member of the Joint Committee on Atomic Energy. We've had testimony on technical matter from witnesses who came from the old AEC and now from ERDA, from the Nuclear Regulatory Commission and other governmental agencies. But as I recall the events of the past, it seems to me this is perhaps the first time that we have had a conference organized by the government exclusively devoted to identifying and trying to resolve the public policy issues surrounding nuclear waste management, at least during the more than 13 years I have been involved with the nuclear program of our country.

I'm very happy to see that the organizers have brought together some of the very best academic and legal minds that are available to join with those within the government who have some role in shaping public policy. Hopefully, that includes everyone in this room this afternoon.

I have no doubt that we all agree regardless of what other aspects of this question may tend to divide us, that to make the decision to safely and permanently isolate both military and commercial nuclear wastes is a matter of high national priority. The public awareness and concern is rapidly reaching a point where the viability of this energy resource is going to rest on the ability of the government to make a decision which is acceptable to a wide range of interest groups. It's also become clear that in order to assure that the decision is broadly consistent with the public interest, a wide range of citizens and interest groups must share the responsibilities in making that decision. Georges Clemenceau once said that war is too important to leave to the generals; and public policy in this area is too important to leave to either politicians or scientists alone. We have to bring in that much broader component of the generalized public interest that does exist in this great country.

I think we can probably also agree that the public record shows that we have had serious problems with respect to making the necessary waste management decisions. From the leaking of the military waste tanks in Hanford through the recent revision of the NRC rule on light water reactor waste management that was ordered by the court by our judicial system, the record contains numerous examples of missed target dates and uncertain policies on when and how and where to begin reprocessing and waste isolation. There is in the record as well some insensitivity on the part of the government and the private sector (including some public interest groups) to resolving these problems, especially in the light of public perceptions of problems in the waste management program.

So there is a compelling reason to significantly enlarge the existing public record and to introduce new people and solutions into the public policy decision-making process. However, recalling events

of the past, I have to confess that I am not entirely sanguine about the public benefiting from this kind of restructuring.

The history of public debate on the nuclear program has not always been a proud record. It has too often been saturated with witnesses who have drifted from the real purpose of public hearings, and have sought to use the forum as a personal soap box. The record does not adequately address, therefore, the source of growing public dissatisfaction in some of the directions that have been taken. It, in many cases, calls attention to the symptom. I would hope, and in agreement with the conference directive, that this would not occur at this conference. And perhaps for the reason that you have left outside of the framework of this conference the question of the wisdom or lack of wisdom of pursuing nuclear energy as an alternative source of power, perhaps that will not be true.

As I mentioned a moment ago, the unresolved policies in nuclear waste management present us with a situation of great complexity and significance. In retrospect, the decision 30 years ago to start a civilian nuclear power program in this country was not a difficult decision to make. We had at the time a great decision to make that involved the defense of our country. We knew that the Nazi's were working on something special. We weren't always really quite sure what it was but knowing generally that they were trying to create the kind of super weapon that could bring victory to their cause in a very sudden and dramatic way set the stage for even a democratic society like ours to make the decision to go ahead with a nuclear fission program for military purposes. We even found it necessary to do it under the extraordinary conditions of wartime secrecy that are so antithetical to our democratic process.

There are politicians other than those who are running for President who have an interest in theology. I am one. Recently I was reading an article by John Richard Newhouse from New York City. He has written a very interesting article on the prospect of democracy; he refers to the fact that every problem that we have today has to be defined as a crisis, whether it's the energy crisis, the environmental crisis, the population crisis, the crisis of the demands that are being made by the third and fourth world for a new economic world order. All of these things are defined in terms of truly critical proportions. The basic question is, is democracy really adequate to deal with the problems of that order of magnitude? We have a fondness for endless public dialogue, and we have a political system consisting as it does of an arrangement of separated powers and checks and balances.

And under these very peculiar circumstances that exist today, Newhouse raises the very pertinent question, "Is democracy really ever going to be able and competent to deal with critical problems?" Fortunately, he goes back into history and suggests, and I think quite correctly, that this has always been the case with democracy. We

always had that essential conflict between our desire in the decision-making process to give everybody a voice and to hem in, with all kinds of safeguards and guarantees, the manner in which we make decisions in the name of due process and all the rest of our constitutional liberties.

That's always been the case. In those societies in the western world, starting with Italy in the 1920's which decided that it was too much trouble to find a solution via the democratic process and trade democracy in for fascism, they found that even then the trains didn't run on time. Or if, as they did in Germany, they chose to abandon the democratic constitution for what seemed to be the more efficient, if inflexible methods of dealing with national problem, that was represented by the fascist brown shirts of that day, they reaped the awful consequences that we all know. So, in perspective, it is helpful to note that this has always been the problem of a democracy. We cannot take refuge really in the thought that things are that much different today. We must drive this democracy to yet another important decision.

Let me hurry on to say that it is to some extent ironic and disturbing that in the face of the commitment that has been made on the part of the private sector to the development and use of nuclear energy that government has not yet totally resolved this issue of how to handle the waste products that are produced by our nuclear power plants. Because of the successful operating record of these plants and because of the important role that nuclear power is expected to play in the future, people are demanding now that waste management plans and practices be laid before their eyes and that they be given a voice in whether or not these practices are adequate. And they are demanding this right before massive commitments are made that could be irrevocable.

I think those are reasonable requests on the part of the public. Nuclear wastes are highly controversial in their own right. They are highly radioactive and toxic. We can argue over the volume that will be generated, as I did with my opponent in Rockford the other night. He made the statement that by the year 2000 the volume of reactor wastes will be so extensive that they would fill a four-lane super highway stretching coast-to-coast to a level of four feet. Now I was a little surprised to hear that, and I dare to suggest that I think it represents a certain misrepresentation in that he made no distinction between high- and low-level waste. Other people talk about the area of a football field 10 or 12 feet deep filled with high-level waste that would be generated by the plants that we will build and have in operation between now and the year 2000.

I don't think the public really cares whether it's a football field or a four-lane highway. In their minds, it's still the unresolved aspect of the issue that bothers them very much. Their bottom line is that in either amount we are going to be confronted with nuclear waste in a volume that could be deadly and dangerous and

polluting as far as the environment is concerned and we must find ways of dealing with it now.

Over 30 years ago, the AEC began running plutonium production reactors for our weapons program. As I indicated, the liquid high-level acidic waste from these reprocessing plants has been stored in tanks, which because of age and the nature of the radioactive liquids themselves are becoming worrisome to public officials and those in the private sector as well. The presence of materials like that for this long period of time has come to represent to the average American a kind of lesion that is there and needs to be treated. And they correctly ask, why aren't we solidifying and isolating these wastes as we go on? Why do they just simply sit there in tanks that might leak when everybody is claiming that they could be put into a solid form where they would not offer that same danger of leakage? Why has there been a go-slow attitude, or is there really no good solution after all?

Now these are legitimate questions which have troubled me personally as a member of the Joint Committee, and I have from time to time discussed them with some of the officials in the AEC and its successor organization, ERDA. Sometimes, very frankly, I have been reassured by what I've been told and there are other times when I must confess to the same frustration and impatience that characterizes the thought of the so-called average laymen when he thinks about this subject. But we have to confront the very real fact that the American people are increasingly restive and that we, as responsible elected officials and those particularly who are in various segments and components of the great great private sector, have to realize that this is a problem which simply cannot be put on the shelf and pushed into some indefinite point in the future.

I should also point out that the disposition of commercial wastes is in some ways unrelated to what this nation will do with our military wastes if we decide that the further development of nuclear power is not in the national interest. These military wastes are still going to have to be secured, taken care of and dealt with in a satisfactory manner. The security that we enjoy militarily, the standard of living that we usually take for granted are tied to these wastes and their permanent isolation has to become a matter of high national priority whether or not we move on with light water reactors and beyond that to generation of breeder reactors.

Now very briefly, a few comments on commercial wastes. As I have said, whether you take one person's estimate of somebody else's, the volume of commercial waste is comparatively insignificant when compared to the volume of military wastes that are already in existence. If we were to decide to stop further nuclear power development, it would probably be a relatively simple matter to include existing and future commercial wastes in with the program that would be developed to isolate

existing military wastes. But if we continue--as I think we will, and are obliged to do--commercial development of nuclear power, then it could very well be more prudent to allow for using these military wastes as a stimulus to testing and building a safe and sophisticated system for processing the growing volume of commercial wastes.

You know, we've gotten ourselves into a somewhat dangerous dilemma. Experts even from government today are not entirely credible in the public mind, even when they are dealing in the area where they have acknowledged expertise. I happen to think that Professor Norman Rasmussen of MIT has been a very creditable witness before our Committee and the Congress as a whole and indeed to the entire American public on the technical issues that are involved in reactor safety. I have to say that I don't think that Mr. Nader, in spite of the publicity that has been given to almost every statement that he makes on the subject, has or can claim to have the same background, the same technical expertise, and the same kind of creditability as Mr. Rasmussen. But Mr. Nader is, and he has to be given credit for, in any realistic assessment of this whole problem that we are discussing, being an expert on developing perceptions on this question.

So far, in trying to deal with this question we've left it pretty much to the technocrats, as I would call them. They have proposed solutions which I, as a member of the Joint Committee, and as one who sits from day-to-day deciding and voting on authorizations and appropriations of public funds to carry out these plans, may think are entirely adequate and a safe way of dealing with the matter. But what the public policy experts in the field are telling us is that the people, whom we represent whether we are in Congress or in an agency in the Executive Branch or whether we represent people in the sense that we are selling a service to them ultimately as consumers, don't yet perceive these solutions as being adequate--or at least that the principal shapers of public opinion don't see them as being adequate. And that is the dilemma. That is at the heart of the dilemma that we must resolve now or it is going to continue to plague us.

The American people want to know very basic things about nuclear power and nuclear waste management. They want to know if they are going to be injured by it. They want to know if they are going to have to live in terror as special nuclear materials are shipped around the country. They want to know if the presence of these materials is going to be an incentive for increased terrorist activity. They want to know if it's going to get back to their food chain, if it is disposed of improperly. They want to know what requirements are being imposed on their children. You'd be surprised at the number of times that this question has been raised to me personally.

The question asked of me is: "Aren't we really doing an awful thing from a standpoint of simple morality to impose such a burden on

untold generations stretching into the future?" Well, our people want assurance that these questions have answers that will work. And when they find, unfortunately, experts disagreeing and even disagreeing violently on one of these questions, you can well imagine their consternation and confusion.

Now, I think we've got to concentrate as public policy makers on trying to find simple, as opposed to simplistic, answers. I don't find too many people that expect that nuclear energy can be expanded, that it can be exploited and used without any risk at all and without some cost. But it's got to be explained to them in terms that indicate that the price that we are going to be asked to pay, whether it's in terms of the risk that we assume as a society or as individuals, is a reasonable cost -a reasonable risk- when compared to the benefits. There's got to be a proper cost-benefit ratio. I think the average American understands the truism that there really is no such thing as a free lunch.

Well, what about waste management risks? Do we understand them or don't we? I think there are some things that we can specify with some assurance. One is that we can predict the volumes of high- and low-level waste that will be produced in the future. We can predict how toxic they will be, and for the most part what their biological effect will be. There is still some residual controversy, I know, regarding low-level radiation effects and concern over our waste management practice as it affects those wastes. But for the most part I think I am correct in suggesting that we do know very well what these wastes are capable of doing in a biological sense.

Now the nature and problems associated with high-level wastes are certainly known as well to the extent that we know that they are highly toxic and therefore they have to be isolated for extremely long periods of time. We also know what the isolation time for these wastes must be, and I think at least some of us are confident that these high-level wastes are not really going to be all that attractive to terrorists. But again, that is something we have to find better ways of explaining in fairly simple terms to the American public.

The list of uncertainty is of course much longer than what I have just outlined. I hear some other questions I think we have to be prepared to deal with. How isolated should the burial grounds for low-level waste be? Should the actinides be removed from these low-level wastes? Should they be removed and treated separately from the high-level wastes? On another score, how vulnerable are reprocessing facilities to terrorism? How possible is it for terrorists to secure strategic quantities of nuclear material? How does one assess this cost-benefit problem for future management of our wastes? What responsibility do the Federal and state governments have, for example, for an installation like the Nuclear Fuel Services plant up there at West Valley, New York? Should nuclear fuel cycle centers be located

at the same place as the repository? How should people in that area come to review, accept or reject such a decision?

I'm sure that many of these questions are going to be discussed at some of your later sessions. I repeat that I think we are at a crossroad in our country. You have been invited to this conference because you are interested and, more importantly, you are here because you are influential in forming and in shaping public opinion. And to that extent, you are all in a position to make a contribution to a solution of this public problem or this range of public problems that we are discussing. People from the ranks are called on sometimes, whether they always appreciate it or not, to make decisions that affect all of us on a national scale.

I'm a representative in Congress, and as such my primary responsibility is to approximately a half a million people who live in northwestern Illinois, in seven counties of that district. But as a member of this Committee and in surveying a problem of this kind, I also have a much heavier and much broader responsibility to act in the overall national interest, and I have to try to rise above my parochial sphere of influence in assuming that mantle of responsibility.

I guess that would be the closing challenge that I would leave with you. When we are talking about a problem like this, and particularly I speak to those from the private sector who represent the commercial and public interests, it's very hard sometimes not to take the bottom-line-balance-sheet approach to this problem. Unless we are willing to freely confess our past sins of omission and commission and our failures even as we seek new avenues and new approaches, we are not going to succeed in regaining the confidence of the American people on this issue. And that confidence is going to be essential to any acceptable solution to this problem. Thank you.

LUNCHEON SESSION, Thursday, October 28

SPEAKER: ASSEMBLYMAN CHARLES WARREN, COMMITTEE ON RESOURCES, LAND USE AND ENERGY, CALIFORNIA STATE LEGISLATURE

Mr. CAMPBELL: I would like to introduce our luncheon speaker. He is Charles Warren who is a member of the Assembly of the California State Legislature. In that role he had a most significant place in the considerations in that state on nuclear power development. Assemblyman Warren is serving as Chairman of the Resources, Land Use and Energy Committee of the California Assembly. He also serves as Chairman of the Energy Task Force of the National Conference of State Legislatures. He is a member of the environmental advisory committee of the Federal Energy Administration. He graduated from the University of California at Berkeley with degrees in economics and law and has been the primary author of legislation in the areas of energy resources and development, and in nuclear safeguards. He, therefore, comes well prepared to talk to us about the topic of our conference and he intends to do that within the general context of the development of nuclear power. It's my pleasure to introduce Assemblyman Charles Warren.

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Mr. WARREN: I've heard comments and complaints that the Conference is not adequately or properly balanced in terms of participation and presentation. I cannot respond to the criticism except for the luncheon speakers. Frankly, I think the sponsors did their best in finding a nuclear pessimist and a nuclear optimist. Yesterday, you heard from the "nuclear pessimists" represented by the Honorable Congressman John Anderson.

I gathered from his remarks the nuclear industry is in some peril and there doesn't appear to be a way out--at least none that he could identify for us. As I understand his description of the situation, he said somewhat as follows: "There is a record of serious problems which has been dealt with by insensitive managers; in response to this record and insensitivity, public awareness and concern is rapidly arriving at a point where a decision must be made." He said that this decision must be made in a democratic manner despite the feeling of some that crisis problems should not be handled democratically. He agrees with those of the public who are demanding answers and that we have such answers before we make a massive nuclear commitment.

He noted that leakage of nuclear waste caused questions to be

raised which he believes are legitimate. He went on to say we have to confront the fact that the American people are increasingly restive and that nuclear waste is a problem which cannot be put on the shelf; that if we decide continued development of nuclear power is not desirable then we have gotten ourselves into a dangerous dilemma.

He said the technocrats have been dealing with the waste problem in a manner which the people do not see as being adequate. They want to know about terrorism, future generation responsibility and morality. They want assurance, he said, and when experts disagree they become confused. He noted there were other nuclear problems and that the list keeps growing.

Unfortunately at this point he said he had to close his remarks. But I got the impression that with a few more minutes he would have circulated a nuclear moratorium initiative.

Now for the balanced presentation, let me give you the views of a nuclear optimist.

My point of reference at this time is the relationship among nuclear waste management, nuclear fission and national energy policy. It will be my thesis that there cannot be a national energy policy until there is a formal and public assessment of the extent to which nuclear fission is an acceptable energy source, with waste management only one of several primary issues. Responsible consideration of energy policy seems to require this assessment since today it is conceivable that nuclear fission will not play a significant role in meeting future electricity requirements.

To the extent energy policy involves the formulation of a desired energy demand/supply equation, the presumed availability of power distorts consideration of the role of supply alternatives and minimizes the need for reducing demand through conservation. Thus if nuclear fission is assumed to be available to accommodate a third or half of our electricity demand, then to that extent there is less urgency to consider coal and other resources and our inattention to conservation strategies can be prolonged. As we all know, current policy assumes unlimited nuclear fission availability.

However, there is evidence to suggest that this assumption may be short lived. We may soon discover that not only is our coal development policy inadequate, our energy conservation program nonexistent but that nuclear fission is not available to the extent necessary to meet its assigned role.

Let's assume the so-called worst nuclear case, that nuclear fission is not available as a commercial energy source. Would not that fact itself cause a significant increase in our attention to energy conservation measures? Would we then not consider coal and other resource

development options more urgently?

In my opinion, and for reasons Congressman Anderson did, it would be prudent at this time to assume this worst case, while simultaneously, carefully and fully assessing the role of nuclear fission in our country's energy future. This means that during the period of assessment we should begin to put into place strong energy conservation and develop supply strategies as if nuclear fission is destined not to be as significant as now assumed.

This approach, while allowing us to keep open the nuclear option, keeps us from the outer reaches of a technological and political limb from which we might some day be unable to extricate ourselves.

I believe it is also important to begin this nuclear assessment effort as soon as possible. It should be emphasized that now may be the only time to do so, as later it may become impermissible, if not impossible, for us to develop alternative non-nuclear policies.

In addition, the longer assessment is delayed, the more likely there may be a politically-forced decision based on invalid technological and scientific considerations. All should agree that whatever the decision, fundamentally a political one, it should include accurate scientific and technological information.

Let me share with you my reasons for believing the non-nuclear case is more than a possibility. Most, if not all of these are well known.

It is clear there is growing concern about our present and planned reliance on nuclear fission and that this concern is developing in other countries. This concern, as some argue, may be for reasons which are invalid; but the concern exists and that is what is important.

This concern is coupled with an awareness by people generally that energy-related decisions are significant and it may affect them in ways not clearly understood nor necessarily desirable. Their awareness and concern has led to the formation of citizen groups who are unwilling to leave such decisions to those who have traditionally, customarily and exclusively made such decisions. In a word, the energy decision process has been politicized.

Politics is a chancy business and sometimes unattractive. It cannot be conducted in a laboratory or in a manner recommended by the Harvard Business School; but I respectively suggest that the technicians and administrators, whether corporate or regulatory, had best learn not to ignore it, if they can't learn to love it.

In the past six months there have been several examples of the politicalization of energy decisions.

In California, although the voters disapproved a nuclear safeguards initiative, they did so only after the legislature passed three well-publicized bills. Of special interest to this Conference is the bill which deals with waste management. It provides in summary as follows:

"No nuclear fission thermal powerplant shall be permitted land use in the state until there has been developed, and the United States through its authorized agency has approved, and there exists a demonstrated technology or means for the disposal of high-level nuclear waste."

Another politicalization example is that in Sweden, Thorbjorne Falldin and the Center Party defeated Olaf Palme and ended 43 years of governance by Social Democrats on a platform which apparently featured opposition to further reliance on nuclear power.

Meanwhile, back in this country, citizens in six more states qualified initiatives which imposed barriers to nuclear development. It appears likely these initiatives will be approved in at least three such states, and in perhaps more next Tuesday.

While voter and citizens group activity increases, some energy policy professionals appear to be less sure in their nuclear confidence.

The Environmental Protection Agency announces its policy on waste management. It provides: "If a safe ultimate disposal method is not found quite soon, expanded use, or even continued nuclear energy from the fission process would be very difficult to support."

In Great Britain last month, Her Majesty's Royal Commission on Environmental Pollution reported to Parliament, among other things, that: "There should be no commitment to a large program of nuclear fission power until it has been demonstrated beyond a reasonable doubt that a method exists to ensure the safe containment of long-lived, highly radioactive waste for the indefinite future."

In a paper prepared for this Conference, a Nuclear Regulatory Commission task force reports that: "We must assure ourselves that safe systems can be implemented to manage the waste from a vastly-expanded nuclear program before proceeding with that program"--and, in all respect, it seems to me that this is what Congressman Anderson was saying to us yesterday.

Nor have the courts remained silent. In commenting on the failure of industry and government to consider adequately the waste management problems, the Court of Appeals for the District of Columbia in its Vermont Yankee decision recently noted, "In substantial part, the materials uncritically relied on by the Nuclear Regulatory Commission ...consist of extremely vague assurances by agency personnel, that

problems as yet unsolved will be solved...Not only were the generalities relied on in this case, not subject to rigorous probing in any form but when apparently substantial criticisms were brought to the Commission's attention, it simply ignored them or brushed them aside without answer ...This type of agency decision cannot pass muster as reasoned decision making."

Of equal, if not greater, significance to all the foregoing, is the attitude of utility managers themselves. In 1973, orders for 35 reactors were placed. In 1974, orders for 29 reactors were placed; in 1975, four. So far, in 1976 only two have been ordered.

And only last week a Wall Street advisory firm advised its clients to drop the stock of utilities with a heavy nuclear commitment because of safety and fuel cycle problems, hampering licensing and operation.

All this indicates to me, at least, the need to commence as soon as possible a formal and public assessment, not just of waste management but of the role of nuclear fission itself as a factor in energy supply.

Some might argue the extent of the inquiry being limited to considerations just of waste management. However, waste management is but one of many unresolved problems or issues in the nuclear fuel cycle. If it is dealt with exclusively and solved, it will be found as the heads of the monster hydra--two problems will emerge to take its place. For this reason, assessment should prudently be of the entire fuel cycle and address as best it can all the unresolved and unanswered issues.

The list of such issues is impressive, in both its length and significance. Several absolutely basic and essential aspects of nuclear power are included.

We can start out with waste disposal itself. As this Conference can attest, there is no commercial demonstrated method of disposing of high-level radioactive waste. Although a means for doing so has been sought for 20 years, there is yet to be located a viable long-term burial site. There has yet to be demonstrated the technology needed to vitrify waste before burial; and there has been less than satisfactory success in isolating existing waste in tanks where they await long-term storage.

Of more complexity is that waste disposal solutions will not be self-implementing. It will require a great national commitment to put a solution in place and in all probability, people must be dependent upon to practice at least nominal surveillance. The record to date does not suggest that high confidence can or should be placed in the infallibility of human efforts and the permanence of social institutions.

The whole complex of questions involved in waste management alone is adequate cause to defer a nuclear commitment since it goes directly to the heart of the public safety issue involved. The simple fact is that we have not yet demonstrated a mechanism for achieving the necessary degree of isolation even for a few years, far less the time frame of perpetuity characteristic of high-level waste toxicity.

A second unresolved and unanswered issue is reactor safety. While the nuclear industry and the Federal government both seem confident that nuclear is safe, clean, and cheap, the safety guarantees have not been accepted uncritically, and this question has sufficient currency to justify review. While there is not time to discuss this issue in detail, it is argued fairly effectively that safety systems have not been adequately tested; problems with quality assurance have not been resolved; and human fallibility ensures uncertainty in system performance.

The Advisory Committee on Reactor Safety's official list of "unresolved safety items" consists of 27 such items; including such major questions as pressure vessel failure, common mode failures, advisability of seismic scram and emergency core cooling capability.

In rebuttal, it is pointed out that the safety record is excellent and that further reactor safety research will provide the final word. Yet the prestigious American Physical Society reached the conclusion that the research currently planned gives no assurance of actually being able to resolve the questions which have been raised about reactor safety. No wonder the public is uneasy as Congressman Anderson told us yesterday.

The third issue is economics. The costs of nuclear power, particularly investment costs in nuclear power generating stations, have escalated rapidly since 1969. As a result, nuclear power is now acknowledged to be only marginally competitive with alternative generating forms. The vision of nuclear power too cheap to meter has given way to the reality of massive investment requirements. The most recent official cost analysis argued for an average generating cost advantage for nuclear power of 17 per cent.

However, that study included all environmental cost associated with coal, and assumed unachieved efficiencies in the use of nuclear power stations. Most critically, however, the 17 per cent advantage did not take into account the massive public sector expenditure associated with nuclear power.

Examples are: Price-Anderson liability limitations, the two-billion-dollar-plus ERDA commercial nuclear budget; and commitments to support portions of the fuel cycle out of public revenues instead of utility prices. These public costs of nuclear power may not be restricted to the Federal government, as is demonstrated by Getty

Oil's attempt to force the State of New York to accept responsibility for management of the high-level liquid waste now stored at Getty's defunct West Valley reprocessing plant.

The fourth issue is uranium availability. Recent research indicates that domestic supply shortages may develop during the late 1980's with the possibility that inadequate mining and milling capacity could cause shortages as soon as the early 1980's. Domestic supplies are declining and available only at increasing prices, as Westinghouse well knows.

The General Accounting Office recently reported that ERDA had no better idea of uranium reserves than the Federal Power Commission has of natural gas resources. I do not believe this observation was intended as a compliment.

It is true that American utilities could turn to foreign supplies since the United States recently lifted its embargo on uranium imports. However, the availability and prices of foreign resources are less certain then our own. Of importance to some is the fact that this course of action would lead to further dependence on insecure non-domestic supplies, and the recently revealed Rio Tinto zinc cartel certainly bears out the validity of this concern.

Another issue is breeder reactor/commercial reprocessing. In large part, due to the problems discussed, particularly the escalating cost of supporting nuclear fuel cycles, supply availability and price problems, the nuclear community has proposed conversion from the enclosed fission fuel cycle to more complex cycles. The latter involve the reprocessing of fission reactor fuel to recover fissionable uranium and plutonium, and the use of breeder reactors to increase the power production available from the limited uranium resource base.

Incredibly, although neither technology--reprocessing or breeders --has been commercially demonstrated, we are asked to accept new and unknown types of health and safety risks and the investment of massive quantities of capital.

The long history of failure in the attempts to institute commercial fuel reprocessing is well known. No facility currently exists to do so. As might be expected, attempts are current to provide public funding to complete the most recent effort at Barnwell, South Carolina. Uncertainties in reprocessing economics justify a suspicion that it may cost more to reprocess the fuel than the recovered uranium and plutonium is worth. It may be that this consideration explains the private sectors unwillingness to complete the Barnwell facility.

If, because of uranium scarcity, a breeder technology must be developed to justify the capital investment in light water reactors,

it would seem prudent to know more about breeder technology before greatly expanding investment in light water reactors.

What do you imagine the public reaction will be when they learn that by the phrase, "hypothetical core disassemblies" the nuclear community means "nuclear explosion"?

A further point, which is quite topical, is the fact breeders will inevitably result in a commercial plutonium economy. A current generation fission reactor produces plutonium at an annual rate of roughly 150 kilograms.

Plutonium offers two major threats; first, it is highly toxic and minute amounts inhaled or ingested are fatal; second, it is the material of which Theodore Taylor said, "There is good, better and worse, but there is no non-weapons grade plutonium involved in the nuclear industry." Roughly 10 kilograms of the material is adequate for the construction of a crude fission bomb, and the commitment to a reprocessing/breeder technology and a plutonium economy will inevitably involve the possibility that plutonium will be acquired by irresponsibles, whether terrorist gangs or terrorist nations.

All the questions supposed and observations made indicate to me the need for assessing all aspects of the fuel cycle. Assuming a willingness to make such an effort, what should be the nature of such an inquiry?

There are several mechanisms which might be used to undertake that assessment. I'm not prepared to recommend one over another; whichever is selected, however, it should at the outset be public and formal. By "formal" is meant a declaration of purpose in a manner sufficient to give maximum notice to all interested parties; by "public" is meant the opportunity for full public participation and exposure to the process.

In addition, the assessment proceedings should be fair, comprehensive, and open; they should be acknowledged by all to be such. The need for fairness seems obvious; we've clearly established over recent years that strong views are held by many members of society on the subject. If an effort at national assessment is to have any useful result it must be conducted as an investigation and analysis, not as a means to support a pre-determined conclusion.

The need for comprehensiveness is perhaps more subtle but equally defensible.

The consideration of the issues listed above without consideration of the synergism between them is simply not adequate; we need analysis of the nuclear fission commitment, not simply the component issues.

A technological "solution" to the waste disposal problem would not eliminate waste disposal as a consideration in the debate over the nuclear commitment; it would simply alter the effect of waste disposal considerations on the ultimate commitment decision.

The requirement that such an assessment be open arises not simply from today's political climate, but from the failure of closed decision processes to adequately deal with the issue--and the issue is essentially one of national commitment. To the extent that the issue is one of risk assessment, the risk is to the public. To the extent that the issue is one of economics, the cost will be borne largely by the public. And, most critically, there is no justification in American political practice for the use of anything but an open process.

Finally, I want to deal with the consequences of the act of assessing itself.

For purposes of argument I will concede the possibility that assessment might prolong the present pause in nuclear development, but an extended pause will not have profound effects. If the assessment determines that the nuclear path, either the present fuel cycle or some other, is what this nation should follow, then interim alternative sources will have been used only for a relatively short period.

Two researchers of MIT, Paul Joskow and Martin Baughman, recently included such a pause as one scenario in a computer analysis of the future of the U.S. nuclear industry. They concluded that the long-term effect would be relatively small, both in terms of electricity prices and the number of nuclear power plants that would eventually be constructed.

On the other hand, if the result of the assessment is that we should not build more power plants, then alternative options become more urgent. But at least we will know what we must do and we can begin promptly.

Of overriding concern to me is that this policy I have outlined provides for a safe-failure; that is, if the policy adopted proves to be an error, the consequences will be minimal. We will not have made a policy decision based on assumptions which are later found to be incorrect, compelling abandonment of the entire expanded program.

While technicians and engineers should strive for fail-safe devices, it seems to me those responsible for the public interest in policy making should always recognize the possibility of being wrong, and strive for the safe-fail solution. If it is learned that nuclear issues can be accommodated at a level of risk and price the people are willing to pay, then the consequences of assessment will be minor.

Today's policy, on the other hand, seems to be a bet on a long shot--a commitment to a high consumption, high-energy production path of which everything must work in a fail-safe manner. But if we find we can't close the fuel cycle or can't solve the proliferation puzzle, we will be in the position of the person who finds the path taken has led him to a precipice.

Let me conclude with a hope that the assessment, if undertaken, results in the identification or development of means which will enable policy planners to return to the earlier days of enthusiasm when nuclear energy was thought to be environmentally clean and economically abundant. Thank you very much.

QUESTIONS IN SESSION I*

For: GREEN

The entire governmental structure is based on the concept of representative government. Isn't the concept of throwing the decision-making process into the public arena at odds with the legislative determination establishing expert agencies to make informed decisions? Allowing public input seems very different from turning the decision-making process into a national town-meeting, with decisions turned into a public relations event.

For: KUHLMAN

You seem to assume the U.S. will continue to rapidly develop nuclear power and the issue is how to safely manage an increasing radioactive waste volume. Will ERDA's Generic EIS seriously address the alternative of phased abandonment of nuclear power as a means of mitigating the future waste management problem?

What were the criteria used to reach the decision that the first repositories for long-term disposal would be ready by 1985?

With respect to state attitudes, to what extent is the nuclear waste management issue a part of the larger one of states using energy also having the responsibility to help conserve future energy resources and safely control the waste products of their use?

How much influence will public (local, state) opinion actually have on selection of waste repository sites?

As a basis for further discussion, it would be helpful to have specific information on sites and capacities of reprocessing plants and terminal storage facilities presently envisaged for 1985.

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* These are questions handwritten by audience members and submitted during sessions. They are printed here in an effort to show the range of interests and concerns of Conference participants, as well as to provide a more complete record of the Conference. Some of these questions were answered directly, others were incorporated into discussion on other questions, and others, because of time constraints, were not addressed. The questions here are grouped, for ease of reading, by subject and/or by the individual to whom they were directed, and are not necessarily in the order in which they were received.

I understand Northern Wisconsin is being considered as a potential site for nuclear waste storage. Can you give me any information you have on this; such as possible locations, reasons for this?

Has ERDA selected the sites that have the most potential to be utilized as ERDA pilot plant facilities for waste management? What are the top five choices of ERDA for pilot plant locations? Does the state of Wisconsin contain a site of great potential for selection for a waste management facility?

In other conferences on the technical aspects of nuclear waste management, it has often been suggested that the beneficial uses for these materials may constitute a large demand. This conference apparently will not address this subject. Do ERDA's plans include beneficial uses other than re-use of the uranium and plutonium?

If the government is interested in public input, are they willing to fund public participation (travel expenses, etc.) for members of the public other than government and industry representatives?

Are there any plans to develop Generic EIS guidelines for the front end of the nuclear cycle; uranium mining and milling wastes and uranium refining wastes? If so, when? If not, why not?

How can we have a meaningful participative decision-making process when the participants do not have the technical background to differentiate objective facts from emotional appeals?

Nuclear waste disposal appears in the title of this conference. It seems on the basis of the earlier presentation, that you have addressed yourself to waste storage. Are there promising technologies being explored or developed to detoxify, neutralize, recycle or otherwise deal with nuclear wastes? Storage may ultimately be unmanageable.

What is the nature and level of effort of ERDA's nuclear waste R&D programs that are relevant to fuel cycles not dependent on reprocessing and recycling? More specifically, how much is ERDA spending on analyzing, researching and demonstrating the "throwaway," "tandem," and other cycles not involving chemical reprocessing? Is this enough to ensure timely availability of a waste disposal system if there is no reprocessing or recycling?

Since the quantities of "defense" wastes will apparently far overshadow the quantities of "commercial" wastes during this century, what logic is there to evaluating (i.e., separate EIS's) and developing (i.e., separate technical storage facilities) separate waste management strategies?

Since military wastes are so much greater than commercial wastes it appears it needs to be solved first. If it is, the commercial waste problem becomes trivial. Why are military wastes considerations excluded from this conference? Isn't the military waste basically the same problem?

What is the nature of the risks associated with those nuclear wastes presently underground as a result of our below-ground weapons testing program? Why is transmutation not considered seriously in terms of R&D funding levels? Only cost? Comment: General EIS should go to attendees for comment.

What is the volume of ERDA waste now as compared to commercial high-level waste generated by NFS?

I assume that one of the purposes of nuclear waste management is to protect the U.S. public and environment. My question is: how do we protect the U.S. public from nuclear wastes generated in other countries?

With no reprocessing taking place, if nuclear utilities don't classify spent fuel as high level waste, what do they call it?

Why should the decision to reprocess or not, in the case of choice of the throwaway cycle, be left to the utilities, if reprocessing provides distinct advantages in packaging for geologic storage and disposal?

The issues of nuclear waste management are not yet resolved. We would not be here if there were not some chance that these issues may be resolved so as to preclude further nuclear development. What is the list of plausible conclusions which, if reached, would stop nuclear power? What is the list of plausible conclusions which, if reached, would give nuclear power an unqualified endorsement to proceed?

Did you say that no new HLW is being produced? Presumably you referred to current license suspension, but plants now operating must be adding to present HLW volume. What is the yearly increase in liquid waste from all presently operating plants and military operations?

What is the projected economic cost of construction and monitoring, over their expected lifetime (say ¼ mil. years) in current dollars of a typical n.w. repository and all of repositories now thought necessary?

In consideration of the public's high interest in a "solution" to the waste problem, has ERDA prepared a contingency plan for accelerating its program for operation of geologic isolation pilot facilities (salt) ahead to perhaps 1980 or 1981? If not, why not?

Public utility and industry confidence in availability of high-level waste repositories requires technical demonstration as soon as possible. Does ERDA's timetable for respository availability by 1985 reflect the most expeditious yet technically sound program for resolution of waste management issue? To what extent has an intensive and coordinated international waste program been considered to accelerate demonstration of the viability of permanent waste disposal?

During my tenure on the Kansas Nuclear Energy Council and at Kansas State University (during the Lyons controversy) we demanded of the AEC 1) retrievability, 2) monolithic stable solidification, and 3) "safeguards" techniques. You have obviously taken us seriously. Now, we initiated socio-engineering studies that were copied and enlarged by other social scientists. Q: Will these social studies, starting in Kansas, be fully factored into the impact statements? Q: Is my credibility lost now that I am an electronic utility scientist?

You referred to our "national energy goals" in your closing comments. I would like a brief explanation of these energy goals as you see them. Secondly, if you accept U.S. "energy independence" by 1985, or even 1995, as one of these goals, how would our continued assumption of resources from around the world affect the quality of life of other peoples around the world?

For: CAMPBELL

You indicated that all opinions are not qually valid; i.e., more informed opinions must be given heavier weight. You also indicated that there is disagreement on the technical solutions for waste management. How do you conclude that technical solutions are in doubt when ERDA's Technical Alternatives Document (TAD) concludes that there are no unresolved technical problems but rather only development of the facilities and existing technology to handle nuclear waste?

For: MOSS

Your third point of a national energy policy would be to avoid dependence on foreign sources of supply. Can we understand from this statement that in order to avoid dependence on Canadian and South African uranium in the last quarter of this century and beyond, that you support the implementing of a fast breeder reactor program in the USA?

OTHER QUESTIONS

Is it assumed that "consensus" politics and disinterested agencies are in some way "superior" to our adversary process involving the acknowledgement of conflict and attempts at its resolution by political processes?

The thought behind this conference was to allow public input into waste management; how many participants here represent "citizens" groups, as opposed to industry or even college or university representatives who receive funding from government or industry? Since citizens groups do not readily have funds available to pay expenses for participants, was any thought given to funding "citizen" participants to ensure adequate participation in the decision-making process?

As if directed by "tunnel vision," we seem to direct our primary concern toward long term deposition of radioactive wastes and public uneasiness with potential physical/genetic radioactive impacts. This direction is necessary. However, is it possible that an even greater justified public concern--public uneasiness--may lie in the immediate and interim storage of wastes--up to 10+ years at sites that are closer to electrical consumers and that are more vulnerable to unpredictable events?

QUESTIONS IN SESSION 1:

For: BISHOP

Many persons have noted the need for public participation to begin in the goal-setting stage and in setting priorities attached to goals. What if the goals identified to date prove to miss and/or conflict with those of the public? (Example: you note that few persons in your review brought up the issue of risk to the system. Based on the record of research and public attitudes, you have raised something.)

From the vantage points of your NRC responsibilties and your work with the task force, can you rationalize the commonly stated goal for waste management--of absolute containment for hundreds of thousands of years--with the fact that, in terms of radiologic hazard, the waste is little different from many natural materials (e.g., pitchblende) after one-to-one thousand years, and can be expected to be much better contained at that point than these natural deposits?

There seems to be a dilemma posed by the goals developed which require making uncertainties explicit--and requiring public approbations; as example, Dr. Slovic's identification of the public perception of nuclear risks as negative, enhanced by their desire for certainty, which makes identification of uncertainty supportive of their preconceived beliefs. How does the task force propose to deal with this dilemma? Isn't the explicit definition of uncertainties likely to assure the rejection of any waste management option?

Should we separate the issue of current ERDA and commercial wastes and establish safe procedures for disposal before we expand our dependence upon nuclear power?

Your task force report addresses broad questions, proposes general criteria and then discusses the criteria very briefly. Several criteria involve issues requiring detailed considerations which indeed could be the subjects of conferences, etc. I believe this point should be recognized and identified in the report.

Has the task force adequately assessed current research on low level radiation and its potential long-term chronic public health effects?

Two of the six commercial low-level nuclear waste disposal sites have been studies and in both cases movement of radionuclides has been demonstrated. The goals discussed here seem in no way to address

this present real world problem of low-level nuclear waste. What are the goals pertaining to low-level nuclear waste management? Have we met these goals? If not what are we going to do about it? Can we hope to succeed in defining goals of high-level management if we have a failure such as those seen at low-level sites staring at us?

Granted that for any action there ought to be a plan, and for any planning there ought to be a goal. Assuming that we will not be able to develop soon an acceptable "goal," what will happen to action (i.e., to NRC, nuclear industry)?

Will your task force eventually address the detailed issues of the possible ways the goals/criteria can be implemented? Spelling out general goals is useful only if realistic implementation scenarios are also developed.

For: BISHOP OR KUHLMAN

Is there a difference between defense program or so-called ERDA wastes and wastes created from commercial nuclear reactors? If so, what is the difference? What volume of liquid wastes are created by a 1000 MWE reactor per year if reprocessed? What is the radionuclide inventory in these wastes at a time of reprocessing if done in a normal time frame if there were reprocessing? What assumptions are made of burn up?

For: BISHOP AND ROSSIN

Through our taxes, which are utilized to research and develop waste management technology, we are indirectly removing a problem from the utilities. How is this subsidy justified and is it not approaching double jeopardy considering that we also pay utility bills?

For: CALKIN

Since there is currently a waste disposal problem due to ERDA wastes what kind of goals can you suggest which can manifest themselves as substantive or procedural changes which would better handle disposal issues than current administrative procedures, or current educational efforts?

For: HOOS

I believe you stated, in approximate terms, that the public has become frustrated with nuclear technologists whom become social

experts by reading the New York Times. Do you think it is possible that the public may be frustrated with environmental activists becoming technological experts by reading the same New York Times?

Could you comment as a sociologist upon the tension between the need to set up "infallible" systems to deal with nuclear waste management, and the well-known fact that human beings are fallible?

You talked about the "omniscience" of those favoring nuclear power. You ignored the "omniscience" of those opposing nuclear power; for example, Barry Commoner's economic expertise or his ability to predict how people will react to the conservation ethic. At least the technical people favoring nuclear power have the technical expertise.

For: HOWARD

Did I understand you to imply that ERDA's purpose in preparing the EIS on waste management is to justify the program? I believe NEPA requires a neutral, objective approach aimed at providing political decision makers with information for making policy regarding nuclear power development and the associated waste question.

For: MOSS

Are you personally, and as a national leader for the Sierra Club, prepared to publicly voice, and ask for support of a national effort to work out a plan to process, and dispose of nuclear waste? The issue needs to be settled; you could be a leading force, if your goals are constructive. Please consider in your response only the management of waste--not for or against more energy. We have this problem to solve regardless of the debate on supply vs. demand.

The issue of credibility of facts in the record, and sufficiency of response was posed by several panelists, but never fully answered. What is the appropriate level of credible response, how much should be spent attempting to convince some who may be unconvinceable, and what is the responsibility of those who disagree and cause delay for the social impacts, and the real economic and social consequences of their delay? Perhaps "responsible" critics should be asked to state in advance what tests or proof will satisfy, as one test of "responsibility."

For: ROSSIN

You seemed to imply that some of the goals of the task force report simply were not achievable. Could you be more specific? Which ones?

Why is the term "delay" always applied to the decision-making process at the point at which public participation begins or citizens want to exercise their rights?

For: SHARPE

Who are the credible sources of information who should be used to educate the public? You have stated that the public is unable to cope with cost or risk/benefit analyses; on what basis does one predicate positive benefits of further development of nuclear power?

For: SLOVIC

Why do you choose the Eugene (my home town) LWV rather than the state of Kansas as a sampling universe? The Kansans have gone through the process.

Was the wording of nuclear-electricity vs. non-nuclear-electricity quite specific as to source? Did the respondents actually receive more than 25 per cent of their electricity from nuclear? How may we obtain copies of your BNWL study?

Since the public has become so upset about chemicals in food that have even a low risk of causing cancer such as cyclamate, sodium nitrate, red dye no. 2; do you think the public will likewise consider even low risk storage of nuclear waste as unacceptable?

Does the public have the same "perceived risk" of nuclear wastes whether it be high-level or low-level?

What is the relationship between perception of risk and behavior? What does it mean that people do or do not perceive something as having high risk? Do you have any theoretical linkages between how people perceive risk and how, or in what direction, they will take action to change public policy, etc.?

On the basis of your research and analysis of the literature, do you feel it is possible to define within a reasonably narrow range a level of risk which is "acceptable" in the development and use of energy provision systems which involve either conventional or novel techniques? If so, how might we go about this?

Regarding the "low probability, high consequence event" and the tendency of the public to become more concerned as the event is researched and documented in safety analysis or elsewhere, 1) has any research been done perhaps on the impact of the Rasmussen Report on reducing the public perception of nuclear power risk? 2) aren't

there some instances which could point to where analysis and communication to the public has reduced public perception of risk; for example, the introduction of electric power in the late 19th, early 20th century?

What factors lead to high perceived risk--and are special for civilian radioactivity? Does low political power lead to acceptance and does opportunity for influence or comment lead to targeted opportunity rather than substantive risk? For example, Nader acts on a general populist basis, with nuclear only part. Individual acceptability depends on voluntary quality for the same risk, but also for same risk political acceptability depends on opportunity for political participation. That is, will not opening nuclear decisions to the public cause the public to see these risks high enough to expand their political influence (e.g., military nuclear accepted, commercial not)?

Is not the implication of your discussion that as the public becomes increasingly dependent upon nuclear power, they will progressively accept higher and higher risks rather than undergo the uncertainty of changing the power generation system? And therefore ultimately accept an arbitrarily large risk when dependence is complete?

Does it not follow from your conclusions that the nuclear industry is in great risk of any conspicuous accident or incident? Even if Rasmussen is right (problem of meltdown = 1/17000 reactor-yrs) and 1000 reactors exist in 2000, then one meltdown can be expected per 17 years. After the first one, public reaction will be intense, leading to a great pressure towards moratorium. Conclusion: probabilities are irrelevant. Murphy's law will prevail.

Could you identify the impacts of electronic media (TV, radio), from news media (print, papers, magazines) on public perception of nuclear risks? Do you have any data on public perception of nuclear risks over time; any change of opinion over past 15 years?

Do you acknowledge the possibility of a group psychological phenomenon, such as the "risky shift," occurring among nuclear scientists and policy makers, thereby underestimating the problems associated with waste storage? Are you an adherent of Von Neumann/Morgenstern utility theory or are you a member of the small but hardy band of non-believers who feel that measuring one's utility does not necessarily account for all attitudes towards risk?

Regardless which "societal risk/benefit study" is performed: How does society reconcile the situations where 1) risk for X is to the benefit of Y; 2) risk/benefit for New England differs from New Mexico; 3) risk/benefit today differs from the past (1946) or future (1990). This is a corollary to Mr. Calciu's question about 4) risk/benefit to institutions and the generic environment?

How do we interpret the apparent difference between the past major public opinion polls on attitudes towards nuclear energy, such

as those reporting about 78 per cent to 22 per cent for building more nuclear power plants, and the results you report from your recent work with the Eugene, Oregon League of Women Voters sample?

Your presentation assumed that the public is making a decision on nuclear power or waste management. Hasn't a great many of the vocal public already made a decision that economic growth is undesirable and that social change is necessary and that by stopping nuclear power the mechanism will be developed to bring about this change. Is nuclear power or waste management really the issue? Is risk discussion even necessary?

Do you feel this kind of meeting is truly public participation or is it really a small collection of special interest groups? Does the general public even care, let alone understand?

X-ray acceptance benefits are accepted by the public. Is the public fully advised of possible risks before consenting to X-rays? Do medical doctors before ordering X-rays assess total cumulative radiation exposure to each patient and assess risks and benefits to that patient and advise that patient before consent for X-ray is given. Have all of the medical profession been fully educated as to risks in X-ray exposure, or is this even fully known?

For: VARANINI

Your comments on public participation are quite revealing. First, with the explicit "black hats" assigned to "for-profit" organizations, and second, with the implication that the "public" requires both a man with a net and a dollar incentive to participate in proceedings presumably directed at excluding what may be the most knowledgeable participation? In the second, is not government forcing a participation not (apparently) desired by the public at large, perhaps even out of a sense of self-justification?

By "subsidizing input" do you mean a direct funding of public members--such as providing travel expenses to attend policy setting meetings?

You indicated that a moratorium has been established. Moratorium over what? Nuclear power? Birth rate? New freeways? If it is energy what are the people of California giving up?

Has the assessment process with which you are involved in California itself been validated? If I understand your position as one which advocates no movement until the validation process occurs, then I am persuaded by your argument to suggest that you halt all assessment until the impact of the Commission's work is assessed. The open-ended nature of this progression is of course counterproductive to

doing anything. Any comments on whether or how the impact of the assessment process should be analyzed?

You indicated that your goals included avoiding large projects because these could be held up by environmental or other protests. Isn't this a complete "cop out"? Shouldn't we design our political administrative systems so that public input can be had without allowing for paralysis of the decision making process rather than accepting that paralysis as a necessary consequence of public participation? Isn't this a desirable goal?

Concerning the highly-touted California "scheme," have the Governor or the legislature, or pertinent commissions identified in clear terms the criteria that they will apply, in the name of the public, to determine that the particular nuclear operation is safe? Isn't it correct that the decisions that are going to be made by the state government will be no more certain or sound than the same decision made by a federal agency (e.g., EPA, NRC) or a group of informed citizens?

OTHER QUESTIONS:

Does the public have the right "not to know?" Aren't there people who don't want to know about the risks of nuclear power? When the public becomes informed we dictate that this information be given in benefit/risk (deaths?)--terminology which creates undue (unnecessarily high?) concern. Do we have the responsibility not to cause worry (to some extent) among the non-informed public?

It has been asserted that the problem of waste management is an interrelated technical-social decision. Is it not true that the social component has been largely excluded in this decision process in the past? If so, does this not put us at a distinct decisional disadvantage as far as options are concerned?

When the expense of adequate waste management or the expense of dealing with the consequences of inadequate waste management is added to the costs of developing, building and maintaining nuclear power plants currently or within 10 years, is nuclear power an economically feasible endeavor? How are costs of waste management factored into analysis of alternative sources?

Is not the real question, the energy sources available for both the short and long term? Is not the panel confused (i.e., return to big cars in view of the apparent facts concerning oil resources); does not the public have a right to expect so-called experts to be telling them the truth? It appears to me that the responsibility of the experts is to level with the public, telling the facts concerning energy reserves and options. Can we look at this historically? For

example, what kind of public resistance and fear existed at the inception of the use of coal as energy, or even the beginning of electrical energy--and what was done about it by either the government or the industry?

Why wasn't the task force report circulated ahead of time for consideration by this group of conferees? Assuming the panel has read it, what goals do they have difficulty accepting? What goals do they find acceptable? And why?

Why haven't non-biological criteria been used to analyze the impact of the global accumulation of KR-85 on the atmosphere? In particular, why hasn't the possibility of inadvertent global weather changes been examined in impact statements?

If this conference can reach agreement that nuclear wastes can be controlled to protect the public over the long term, then I would suggest public information to sell the nuclear program based on a TV program entitled the "Billion Dollar Couple" whose ability for carrying beneficial actions would be a miniature but safe nuclear plant in their system.

How can one prove that anything is safe?

How does or can a technology allay the large body of fears which are of a social or psychological nature?

I would like to hear the term "public participation" defined.

Is public participation to the federal agencies the "public" (man-off-the-street) or is it the person or organization member who shows up at a hearing--or is it that "public" who you are sure agrees with the federal position but doesn't show up at your hearing? Who are you trying to reach?

QUESTIONS IN SESSION III

For: ROCHLIN

Does Gene Rochlin agree that his "multiplicity" and "irreversibility" criteria are perhaps a "sociologists' corollary" to the Second Law of Thermodynamics? [e.g., maximum multiplicity of sites and maximum difficulty of retrieval appears analogous to the dispersal of one component (perhaps a gas) into a second medium (another gas) with maximum entropy at infinite dispersal or dilution of A in B.]

If so, the criteria may support (and perhaps help justify) the analysis of B. Cohen and others regarding burial with dilution (dispersal) to low concentrations analogous to natural background in soil as an acceptable approach.

For: ROCHLIN/RODGER

The Battelle Lab Report states that the technology has not been demonstrated for any waste management alternative except liquid storage, which has a high probability of dispersion. How can you protect the public today--let alone for all time--with undemonstrated technology?

For: GUTMANIS/ROCHLIN/VARANINI

Why cannot appropriate irreversibility of rad-waste isolation be done by returning radioactive rock to the ground to match the radioactivity of the mined uranium ore? (Variability of concentration to match nature.) Why is this simple natural recycle solution not widely appreciated? What about the costs of public education?

You imply that high "technical irreversibility" is desirable. Not so. I believe that the stored energy in nuclear waste (thermal and radioactive) will be useful and highly desirable for future generations. How do you reconcile "recoverability" with "irreversibility"?

For: ROCHLIN/RODGER

Several panel members, Mr. Rochlin being the latest, have indicated that costs are not as important as other parameters in making decisions or setting goals for waste management strategies. However, electric utilities are constantly under criticism for increasing costs (not just nuclear-related) from their customers and the public in

general. Is it possible that the panel's lack of emphasis on economics in decision making results from an "ivory tower" background which includes not having to face an angry relative whose electric bill has just gone up by 25 per cent or so? (Written prior to Ivars Gutmanis' comment.)

Since high-level wastes constitute a substantial and potentially recoverable storable source of energy, do we not have an obligation to ensure their selective retrievability and thus the technical reversibility of whatever approach is adopted for the storage of such wastes? Would not acceptance of this premise go a long way in gaining acceptance of such a policy since the public, internationally, is awakening to the realization that fossil fuels are finite in nature? Unfortunately, we in this country suffer from tunnel/energy vision. Agree?

For: BISHOP

In formulating goals for a nuclear waste management program and in later fine-tuning these goals into operational objectives, to what extent has the public participated, or to what extent will it participate in the work of the task force? I believe it is not enough to include the public in one goal by saying it will be included in the decision making process further downstream, and to leave it at that. There are techniques for public participation--such as, steering committees, workshops, planning balance sheets and so on--which should be employed as soon as goals are in the formulation stage.

Civil liberties are constitutional. Freedom of choice, upward mobility and freedom to buy all the energy you want are not civil liberties, but are nonetheless important to many people. The goal should (could?) also address the impact of waste management on these "social" liberties.

Might you add these to your goals: 1) We stop producing wastes (period A) before society gives up its responsibility to manage them (period B). 2) A.1.1 Reduce existing uncertainties where possible. 3) A.2.1.1 Consider quantifiable, as well as non-quantifiable, values. 4) A.5.1 Protect not only the public, but also government and industrial people. 5) Do all this in a way that is good, wise and safe as opposed to a bad, stupid and dangerous. 6) etc., etc.

To what degree is the development of an allegedly "acceptable" commercial nuclear waste management program a green light for a massive future commitment to nuclear power development? Is this probable impact of the waste management program being evaluated?

Is it correct that the goals, as read by Larry Moss, may or may not appear in the report of the task force, or may be reworded before it goes to the Commissioners?

In meeting radiation standards, what standards will you choose? How do you know that future standards (i.e., 50-70-200 years) might not be much more restrictive, requiring retrievability and reburial? Also where will standards be utilized--container surface--ground level --site boundary?

Regarding one of the long-term goals that refers to "...all conceivable incidents," isn't that a ridiculous statement? Shouldn't it be changed to something like "...all credible accidents...," recognizing the parallel to design basis accidents in reactor licensing?

For: MOSS

While realizing that this may be a rhetorical question, I would like to ask the panel how they intend to carry out an effective public participation program (if they were so involved) utilizing almost incomprehensible jargon, buzz-words and disorganized logic, which I am at a loss at times to understand, that has been the hallmark of many speeches. If the object of this conference is to aid or provide a forum for public involvement in the discussion of this problem, how do you intend to communicate with the public?

For: MOSS/BISHOP

Am I the only person here bothered by the fact that speakers and panel have spent parts of two days discussing a paper that the public, at what is supposed to be a public meeting, does not have access to and will not for months at best? Doesn't this make real public input at this meeting impossible?

As a scientist working in nuclear waste management, I would like to hear from "the public" what they need to (and want to) know about waste disposal so that they can make a rational decision on whether or not they would allow a waste repository to be built in their community.

For: ALL PANELISTS

Can the panel discuss the apparent conflict between Rochlin's interesting "irreversibility" criteria and what many see as a desirability for at least a temporary (say a generation or two) retrievability option?

How, quite specifically, does this forum "encourage public input in establishing a national nuclear waste management program"? In what sense, also, is "an exchange of viewpoint...(being) solicited to assist federal decision making in nuclear waste management"?

For: VARANINI

Bishop's goals appear in a preliminary draft report. Now the panel's objective is: trying to cast them in concrete for all future discussions. This is totally irrelevant to the subject of our symposium of "public policy issues." How can you justify such an effort based upon an unapproved, preliminary, federal task report? Do you feel that the technical community is in agreement with these goals? I violently disagree. The goals do not represent any agreement at all. They are suggestions.

For: GUTMANIS/SHARPE/HOOS/VARANINI

This conference cannot be used to assess effectively the validity of the draft NRC document on goals. To attempt to do so is not only to bypass an established review process but to railroad one view or another down the throats of those members of the public who are here and who have not had an opportunity to review the NRC work.

For: SHAREFKIN

What special interests of organizations and professionals have operated to exaggerate and make exotic the hazards of radiation in fuel-cycle effluents? When the public finds out it has been mislead on these hazards, whose reputation will be affected?

For: RODGER

How can we, the public, feel assured, and accept as a "solvable problem" the challenge of successfully isolating the long-lived wastes from the instinctive, investigative probings of man.

Do you concur with the statement that only liquid storage has been demonstrated as a waste management alternative? How do you define "demonstrated"?

For: VARANINI

Mr. Stanbrough's question was not intended to exclude public

participation but rather to ask what risk will they accept. Some will accept a coal equivalent; some apparently will not. He is asking for some positive action by the "public" to let the technocrats know what risk level is acceptable.

Please illuminate where the task force report varies from the so-called "stereotype" report.

OTHER QUESTIONS

To what extent did the task force consult with the "public" in the preparation of the "goals" draft report? I would contend that this gathering represents a small portion of the "public" and therefore should be given a chance as soon as possible to review and comment on the document at this stage. It seems somewhat unfair to the audience to talk about the document when we haven't seen it.

If our nation could be founded on the basis of a one page document (the Declaration of Independence) why should the statement of goals for nuclear wastes take the order of 100 pages plus appendices?

Much of the discussion has been concerned with what system will be used to define the technology which will give us a certain low level of public risk. Much of this is entirely subjective and pointless unless a level of risk is defined as a point of departure. Would the "public" accept a risk level equal to that apparently already accepted in use of other energy sources--i.e., the deaths from mining, transportation, pollution, etc. from use of coal (estimated to be anywhere from 200 to 50,000 a year)? If so, current waste disposal technology probably represents overkill rather than inadequacy. If they choose to not be hypocritical, the public should either let nuclear power proceed, or demand the shutdown of both. How do you reconcile these differences in setting up goals? In other words, are you going to set goals by looking at nuclear power in a vacuum and in comparison to the nonexistent ideal world, or in a real-world comparison to other alternatives in use and apparently tolerated?

The discussion by the panel might be summarized as, "How many curies can dance on the head of a pin?" The obsession for quantification obscures what is necessary and should be undertaken. Is not the issue that the scientific and engineering community believes it can solve any problems of waste management while the opposition believes that the best way to solve the problem is to kill the technology that generates the waste?

A distinction has been made between the long-term waste management problem and the short-term (near future?) waste management problem. These are further defined by the reference to "risk to populations" and "risk to the individual." Is it possible that in looking

toward and setting goals for long-term management of wastes and that curious individual we are overlooking the necessary, immediate attention to current waste volumes and current population risks?

In order to satisfy states' rights and the lack of cooperation of most states to aid in the national energy problem, should one goal be to return all wastes from nuclear fuel cycle to the states where the energy was used proportional to the energy consumed?

Since our ability to predict consequences and/or probabilities decreases as time into the future increases (unknowable climatic, geologic, demographic, cultural, technologic, etc. changes), shouldn't we focus our concern--and hence our judgmental base for establishing goals, criteria and standards--on minimizing the near-term, relatively confidently predictable, future impacts? The implicit assumption is thus that adequate near-term management provides the best ability to protect the long-term future.

A recent study by Cornell University, reported in the September 1976 ASHRAE Journal reveals that their research shows previous estimates of health effects caused by routine emissions from the nuclear industry have ignored some of the more important isotopes and inadequate consideration has been given to the persistence of radioactive pollutants. If the nuclear establishment hasn't been able to predict the effects of short-term, low-level radioactivity, how can we rely on them to predict the effects of high-level, long-term radioactivity?

In our attempts to "minimize" hazards associated with waste management, can "minimalization" ever be enough for future unknown changes and developments? One of the goals stated was the elimination of waste management obligations to future generations. Does "minimalization" actually do this?

With respect to the goal of civil liberties, is this not saying that the goals and implementation be consistent with the constitution of the U.S.? What distinction is being made?

QUESTIONS IN SESSION IV

For: DOUB

For over 30 years our government in its infinite (?) wisdom has been producing, processing, and storing here and abroad large quantities of weapons grade U-239. From an energy standpoint its use as a reactor fuel would be the equivalent of trillions of gallons of OPEC oil. God willing, we will soon awaken to the insanities of its currently intended weapons use and accept its role as a major source of energy at a time when our economic survival and thus that of the free world is in jeopardy. Don't we therefore have an obligation to expedite an acceptable waste management program which recognizes weapons-grade uranium as another weapon source of commercial reactor waste less that amount which is currently being produced militarily and which should be immediately terminated?

If we continue to avoid making positive decisions concerning nuclear waste management at the national level are we not subordinating our ethical obligation to protect our present social fabric by assuring adequate energy supplies and overemphasizing our obligation to future generations? Is this a truly objective approach?

Do you really think that there has been and is enough technology for us to make the kinds of decisions that must be made in regard to nuclear waste--or is it that you think the Federal government and its agencies have enough technology to make decisions for us?

Will an applicant have any assurance that he will be able to gain a license which will not be overturned by subsequent court action? Do the recent court rulings reflect prior poor regulation, does it represent a breakdown of our current regulatory process? Will the NRC or appeals court really be the lead agency?

For: DOUB/J. GRAY/E.D. GRAY

Could you comment on the pro's and con's of having the responsibility for setting radiation protection regulations in an agency (such as NRC), separate from the organization which is setting and enforcing other public and environmental protection regulations and criteria (e.g., EPA)? Might such separation lead to unevenness in cost/benefit and public protection tradeoffs on enforcement between nuclear effluents and other effluents (such as may be the case today)?

Being a taxpayer and consumer, I become extremely concerned about the tremendous emphasis on regulation. If regulations are blown out of proportion to the problem, the cost will be phenomenal. What steps would you suggest to protect the consumer and taxpayer from the ultra-environmentalist?

Isn't it possible that rad-waste sites can be located on Federal preserves that are presently being controlled by the Department of Defense? In that way state and local conflicts would possibly be minimized.

For: DOUB/WILLRICH

The discussion about the roles of Federal agencies, the states and the Federal executive branch has ignored the fact that the judicial branch is making, by default, the important decisions, even though they are ill-prepared to do so. Please comment!

Does your "reassertion of Federal authority" mean rescinding present agreements of cooperation with the several states that now have them? Or re-negotiate them?

In the context of your recommendation that NRC have all regulatory authority over nuclear waste management, in which ways do you recommend that the authorities of EPA be diminished?

Could you explain further your views on state involvement in the management of nuclear materials--obligations and limitations?

For: HELMINSKI

How do we begin resolving the question of states' rights vs. national good; e.g., offshore drilling, Western coal and oil shale, tankers, nuclear waste disposal?

For: WILLRICH AND DOUB

Our organization as well as other citizen organizations have been consistently and deliberately prevented from raising valid questions in hearing processes before the former AEC and the NRC. What procedures do you think could assure that the public could be heard and have input into the licensing and regulation and development of criteria for nuclear waste management programs?

For: WILLRICH

It is rather obvious that most of the panels participating in this conference are stacked with anti-nuclear and anti-industry people. Who selected these panels? What were the criteria for selection? Is this the kind of stacked deck we can expect if a waste management authority is created in the future?

For commercial high-level waste, could you identify the nature of the cost and risk that will be passed on to the government?

For: WILLRICH/DOUB

What will assure that a federally chartered organization to handle wastes would do better than Amtrack with passenger rail service or the Post Office with the mail? Why is it mandatory to seek governmental involvement at all? Why cannot sensible regulations be provided to commercial organizations to include all radioactive wastes, and the federal role limited to standards, licensing and enforcement?

The creation of additional bureaucracy does not seem to be the way to manage the rad-waste issue. We already have three federal agencies that have authority in this area. Certainly one of these would be capable of handling this problem. Duplication causes inefficiency and expense! Don't you agree?

Two questions: 1) Given a self-financing National Radioactive Waste Corporation as you propose, what happens when or if it encounters financial problems such as occurred in the postal service? 2) Under what "appropriate circumstances" (your words) would your NRWC not have control?

Both ERDA and any new authority are or could be made subject to the same external incentives, e.g., NRC licensing, Congressional approval of expenditures, public opinion, etc. Assuming that ERDA has established or can establish an appropriate internal structure for its waste management activities and that ERDA can employ personnel as capable as those that would be employed by a new authority, what are the internal incentives that would be applicable to a new authority but would not be applicable to ERDA?

Any nuclear decision-making process or management structure must have the confidence and trust of the public if it is to function successfully. If there has been a "loss of technological fundamentalism" by the public as described by Mrs. Gray, is the country better served by a proliferation of agencies, authorities, commissions, and administrations or by a consolidation of these? Doesn't the public want to fix accountability?

With respect to your position on an organization responsible for

management of nuclear waste, how do you rationalize your position that an agency which you claim is self-regulated with respect to health and safety is unworkable while asserting that a government corporation which is a self-regulated monopoly is the only acceptable solution?

The National Radioactivity Authority you propose sounds like the "new priesthood" described by Ralph Lapp in his book of that title. Dr. Lapp suggests this priesthood is the beginning of a police state or fascist type government in the U.S. and other countries! Please comment.

Since an agency cannot be truly independent, to what branch--executive or legislative--would your Radioactive Waste Authority be responsible and what types of accountability have you suggested which would strike the proper balance between political isolation and administrative responsibility? Beyond separation of functions and broad representation, what demands or controls can or should be put on the chief administrator?

Should we have a Nuclear Fuel Cycle Corporation including the whole fuel cycle from enrichment and fuel fabrication through waste disposal?

How will the government corporation supply incentives, locate waste repositives and prevent sabotage of waste storage facilities with greater effectiveness than could be provided by a government agency?

Would you agree to provide state government participation in the proposed Federal Nuclear Waste Management Authority--perhaps like the Great Lakes Basin Commission? Would such an Authority have pre-emptive authority regarding repository sites for low-level, or high-level wastes?

Why do you suggest the separation of R&D from operational management for nuclear waste when industry has generally found the need for close coupling between R&D and the source of the problem?

One of your criteria for institutes was "built-in management incentives." Can you be more specific? What incentives are you recommending be built into your National Authority? Did your task force attempt to estimate the chances that human error or organizational failure will occur at points during the process at which human management is required?

For: WILLRICH/J. GRAY

A suggestion was made that the ERDA management role is inconsistent

with ERDA's R&D function. Would ERDA's management of Oak Ridge, Portsmouth and Paducah diffusion plants also be inconsistent? How can we avoid the additional delays which would result from additional studies, environmental statements, etc., which the new management agency would have to undertake?

Both this morning (in task force goals) and this afternoon, we have heard that any HLW management program must be structured to respond to any changes in the social environment (either gradual or abrupt changes). What do you mean by this statement? What changes in social environment could you foresee, predict or feel that need to be considered?

For: E.D. GRAY

If rational decisions are not to be used by all of us, and non-rational (better) uniquely personal methods will become the common mode for deciding popular action, what reason is there to expect anything but absolute lack of any action on these controversial, social issues?

How do you explain the statistical increase in life expectancy during the recent (50 years) rise of technology?

Nuclear wastes exist. What do you, as a panel member speaking as a member of the public, think should be done with them? How should a national decision be made?

Until all questions are resolved concerning any technological change we should not take any steps in any direction. Would you agree with this? If so, how then do we live in a technological world?

I agree with what she said. But if a vote against nuclear becomes a vote for coal and coal is worse than electricity, what then? Don't you have to evaluate all options together, and not vote on one option at a time? We have to be very careful of errors. Particularly that there are long time lags in implementation and it takes 20-40 years to correct mistakes.

With all the horrible new threats to life and health facing humanity that you have so well articulated, how is that our life expectancy has not been significantly affected? Should we go back to the "good old days" that we had before recent technological "advances"?

Your alienated and personalized position, while not unique, is important only to the extent that position is not generationally trivial and ephemeral: Does not your belated consciousness of death betray the failure of Christianity in our age?

How do you speak as a "ethicist" yet suggest other people accept risk instead of "invading my privacy." Do you use electrical appliances, electric lights, products made with energy, drive a car, etc. If so, you must accept some energy risk. Would you take antibiotics for pneumonia, aspirin for a headache, etc.? Then you must accept some risk of pharmaceutical problems. How do you feel about the health effects of fossil plants that are real, not hypothetical risks?

Recognizing the intuitive or "gut" feeling that technology has threatened our group survival rates, it is fact not intuition that survival rates (as measured by mean lifespan) have increased not decreased with the introduction of technology. Accepting this fact (from a "male decision-maker"), is your attitude directed more by the manner of deaths (i.e., cancer vs. heart disease) rather than the rate of deaths?

You presented a fine case for an anti-technological society but have you considered the benefits that this technology has given you compared to the people who lived 100 years ago? Are you willing to make the decisions that may in fact lead to a regression in technology and the subsequent reduction in life expectancy?

Considering that some carcinogens (or other type hazards) may be thought to have a threshold level, below which the effects are "harmless," how do you regard being exposed involuntarily to such things, where the exposure is based on the assumption that you have not already been exposed to the threshold level, or nearly to it?

Why do you single out the nuclear power source of your electricity? Are you also as concerned with the pervasive pollution of other sources such as coal? Is there an alternative to turning out the lights?

Given that some problems may not be solvable, do we decide that in advance or after trying?

Why do you approach the "gestalt" of a private citizen from the point of view of a woman and deny, by implication, the same environmental problems to a man? While appreciating your feelings, short of moving to a rural commune in Maine, the average adult is still faced with the need to make decisions in the technical area, including decisions on energy. Life expectancy is far greater than that of previous generations and each individual can still make his own decisions on food, drugs and medical treatments. Energy, regardless of its source, poses problems and the need for decisions. Waste exists from military uses, and if nothing else is considered, this must be dealt with. How can one avoid a decision on nuclear waste?

OTHER QUESTIONS

What is your rationale for involving the states in the disposal of radioactive wastes but not in the production of radioactive wastes? Why should the governor, the states and their publics have to be responsible for wastes they don't want produced in the first place?

What is being done to state the problem concerning nuclear wastes so that the "public" has a clear understanding of them?

It has been suggested that fossil fuel, psuedo-free market pricing or replacement pricing be used with the increased earnings to help fund the development of technology such as coal liquification and gasification, should we consider a policy that would require real time funding for projected future costs of waste management; i.e., a waste disposal surcharge to help pay for waste management R&D?

One of the Presidential candidates has opposed the formation of new federal organizations, and, instead, wishes to consolidate existing Federal agencies. What might be the effects of such an action on the federal nuclear establishment? What might this do to the problem of federal credibility in nuclear waste management and decision making?

How about a television program--Channel 11 teaches young children alphabet, words and numbers through graphic and dramatic illustrations. Could such a program be devised sponsored by the industry and the AEC to educate the layman and/or public? Books?

What is the ethical difference between hundreds of people killed in dam failures and possibly hundreds of people killed in a nuclear accident? What moral judgments permit you to accept known death producers while rejecting an as-of-yet, non-fatal technology? For example, the American Cancer Society predicts 600,000 people will contract skin cancer this year from overexposure to the sun. Would the ethical action be to "ban the beaches" and short-sleeve shirts? Why the unique paranoia about nuclear power?

The solution of the states right problem in managing the nation's radioactive waste is critically needed. The problem is being approached internationally by requiring a nation, which has spent fuel reprocessed abroad, to take the waste back for disposal. In the USA can we leave the responsibility for waste disposal to the individual states which use the nuclear-generated electricity? This may prove to be a multiple state compact since generation and use of electricity may be in separate states and different from the state where the rad-waste will be disposed?

QUESTIONS IN SESSION V

For: ABRAHAMSON

Would you, and on what moral and humanitarian grounds, deny a young man or woman the possibility of having emplanted an artificial heart as a means of survival, because of the concerns you expressed in the dispersing of Pu-238 (in safe and licensed containers)? Are you aware that the plutonium used in artificial hearts and pacemakers is Pu-238 and not Pu-239, the weapon fuel?

During his speech, Mr. Abrahamson stated the view that he felt that the recycling of nuclear wastes into technologically useful products constituted a "dilute and disperse" cop-out to the treatment of nuclear wastes. How does he reconcile this view with the options of David Rose that we also owe the future a legacy of gas, oil and other resources? Surely these resources will be used up at a faster rate without maximizing the use of nuclear alternatives?

Would you please comment on the morality or what right that a developed nation has to create a de facto denial of the nuclear energy option to a developing nation and thus stifle their efforts to improve their living standards.

Do you think that sketches such as those showing mushroom clouds over reactors, put out by certain ECD groups, have done a disservice to open and unbiased debate? What about the responsibility of the press in carrying such sketches?

For: ABRAHAMSON/ROSE

What do you consider to be the long-term benefits or damages to society from abandoning the nuclear power program, with the probable consequences of either (a) gross energy deficiency or (b) early exhaustion of our fossil resources? Are these really preferable to the benefits or damages or continuing the development of the nuclear power source? If you disagree with the postulated consequences, what do you believe the consequences will be?

For: ABRAHAMSON

The public perceives radioactivity from medical use to be of less concern than nuclear radioactivity because they have control

over the use or non-use of medical radiation. When they take the risk it is because they determine the benefit is worth it. The decision is not made for them by the nuclear establishment.

You note that it may be unethical for governments to exercise the right of eminent domain for waste management. Would you care to speculate on the area of land and people displace for highways and hydroelectric projects? I suggest that waste management requirements are a small fraction of these values.

To the issue, the significance of, and necessity for competent criticism: Would you elaborate on your perception of the role of state governments in developing and exercising such functions?

How can you fail to cite evidence of acceptable and benign effects of radioactivity present in the natural world? How can you advocate an "uncluttered" moral absolutism in politics or technology?

Expressions of lack of confidence in the experts' ability to protect the public cite trivial "releases" of radioactivity (but no actual damage) and damage from experts' failures (e.g., thalidomide) from non-radioactive hazards; does not this mean the anti-nuclear case is a consequence of protect opportunity (via nuclear licensing) rather than evidence of radioactive hazard?

All societies must deal with the moral-ethical tension between special interests and the larger whole of society (including future generations); you seem to have forgotten this tension and espoused a populist ethic where the government is not allowed to restrain individuals and individuals can do no wrong.

For: ABRAHAMSON/CALLAHAN

Through what type of forum should the moral issues of nuclear waste management be addressed? I ask this in the wake of a recent moral(?) statement made by the National Council of Churches which pronounced plutonium and a plutonium economy as immoral. Scrutiny of this pronouncement by moral philosophers strongly questioned the ethical analysis used--the pronouncement seemed to be more emotional than ethical.

For: CALLAHAN

The high rate of unemployment in the U.S. today is one of the, if not the, major issue in the presidential election. If we do not pursue a "growth ethic," how would you suggest we create meaningful participation for the unemployed? And does the creation of jobs not also require more energy?

Why do you not cite the need of every person to cooperate in collective society in order to pressure the basic safety and mutual support identified by Thomas Hobbes? ("Leviathan," 1650)

You listed a number of obligations. Isn't there at least one more--an obligation on the part of opponents to various aspects of nuclear power to familiarize themselves (not to Ph.D. level, of course) to the extent they do not parrot untruths, distortions, etc.? Would not the needed dialogue be improved thereby? (It would also help if they would identify the consequence of their proposed actions too.)

For: COWAN/KASPERSON

Cowan suggested that the main objectors to nuclear power are upper middle class. New Mexico Congressman Manuel Lujan surveyed state residents. The strongest opposition was from Northern New Mexico--characteristically poverty-stricken unemployed, poorly educated (grade school level), etc. Can you rectify this data with your statements?

For: KASPERSON/CALLAHAN

Is it fundamentally impossible for technologists to effectively participate in the consideration of social and moral aspects of technological developments and policy decision-making?

For: KASPERSON

If in fact public opinions surveys show approval of nuclear power (at best, decreasing approval), does your suggestion that we await a consensus within society imply that the minority in opposition shall be given veto authority? What are the implications of the view of some in the opposition that nuclear energy is the devil's work with respect to the chances for that consensus?

You stated that with men's as well as women's concern over nuclear power grows as knowledge increases. How then do you explain the opinion change and final endorsement of nuclear power by the voters of California who were 2 to 1 for nuclear in June compared with 2 to 1 against as shown by opinion surveys done in February when knowledge levels were enormously lower?

What were the overall results of the U.S. Harris poll of 1975 and the Canadian poll on nuclear energy? On what do you base the statement that increased discussion and awareness of radioactive waste management among men and women necessarily increases opposition to nuclear energy?

Your astute identification of unique concerns of radioactivity risks in its public manifestation as non-technical and as a hazard and discontent surrogate (for women and non-technologists) raises the question of how political and psychological science may be more directly integrated into our technological society. How about this?

For: SKOLNIKOFF

Is it not true that the highway trust fund has resulted in promotion of GM, Ford, and Chrysler Motors? (GM has a larger budget than all but 34 nations of the world.)

There is an implied value in expediting the flow of information and its interpretation from technologists through agencies to the various publics; and conversely, the flow of values, attitudes and concerns from the publics through the agencies to the technologists. Could you assess the "health" of this present information loop, and specify some of the realistic parameters of an idealized state in the reasonable future?

Assuming the "initiative process" is an effective mechanism for public participation in technical decision making, what can be done to assure that initiative questions are non-biasedly phrased so that the initiative can truly illicit public sentiment on a technical issue?

Noting that the nuclear controversy concerns industrial, not military, hazard, is not the proprietary profit rights of industry the chief source of lack of credibility of experts' assurances of public safety?

Why do you (as a typical engineer) fail to provide an historical, social and political perspective that would activate our cultural strength evident from previous populist opposition to new technology--for example, the muckraking attack on the Standard Oil trust in the development of modern petroleum technology?

You cited the difference between known risks of old technology and unfamiliar risks of new technology; but is not the present nuclear controversy due to an advance in risk assessment, namely that in the past "new" technologies were not assessed ("caveat emptor") but now we are able and willing to assess risks in advance of implementation, and so activate latent populist and Philistine hostility to the novel and the unfamiliar?

What should we expect--and what do you think we can actually expect--from the new executive OSTP in the area of objective leadership for radioactive waste management policy?

For: ABRAHAMSON/SKOLNIKOFF

What means exist in our society to permit full and representative public participation in the basic choice on whether to continue development of nuclear power for peaceful purposes? Is there an instrument that can be used for conducting a national assessment of this question? What are the time constraints that may determine the timing of this assessment?

For: SKOLNIKOFF/ROSE/ABRAHAMSON

Could you comment further on the proposed "science court" as a means to address the issues surrounding nuclear waste disposal?

For: ROSE

In view of the growth and healthy functioning of groups opposing nuclear power, should the press extend its role of critical assessment and demand for ethical conduct to them as well as the nuclear proponents?

Several speakers have alluded to the long term dangers of CO_2 from combustion of all fossil fuel. Please give me a good literature citation.

Could you comment on the degree to which we have already performed the momentous and much debated nuclear waste burial experiment (albeit with much less finesse) with underground testing of nuclear weapons, vouchsafed by the Atmospheric Nuclear Test Ban Treaty ratified by the U.S. Senate?

OTHER QUESTIONS

The statement of President Ford may well have such impact as to pre-empt the subject of this conference and whatever impact it might ever have on the process. What does the panel think of the level of public participation in determining the policy?

The Environmental Impact Statement on the Zion Nuclear Plant states that the plants will emit 4,000 curies per year of radioactive gases. The NRC set firm limits for these emissions at more than 300,000 curies. Environmental Impact Statements become meaningless when viewed in this perspective. Are they just a public relations device? What will be the differential between the Nuclear Waste Management Impact Statement and the NRC's "firm limits" for environmental impact of nuclear wastes?

Is there a relationship between this conference and the requirement of an NRC impact statement on plutonium recycle and nuclear waste management? Is the conference intended to fulfill the requirement of the Environmental Policy Act for public participation in preparation of environmental impact statements?

Why has there been very little, if any, discussion of the feasibility of alternative processes for radioactive waste management--as presented in the NRC-funded Battelle Laboratory report?

Restoring confidence cannot occur when only the list of failures is quoted. Can you quote a list of successes, and, if not, why not? If so, how do their lengths compare?

One of the often spoken problems in this meeting is what damage do we create for future generations--e.g., generation of long-lived dangerous materials. No one, however, seems to want to address the far larger problem of not leaving them anything of value--e.g., oil which is needed for things other than energy. Shouldn't a group be organized to scope this for larger problems so that a yardstick can be constructed against which we can measure the impacts of waste?

Does the President have authority to legally pre-empt NRC on making policy over reprocessing in the areas where licensing is required?

Can't it be said that technically we are through the industrial revolution while philosophically we are still in the dark ages? Maybe we should declare a complete technological moratorium while the ethicists and philosophers catch up. How much will that cost?

Do independent research facilities need to be established to separate technological (scientific) processes from special interest (perhaps, industry) pressures--as one step in appealing to the public's trust?

The President has more or less placed a ban on reprocessing nuclear fuel and of exporting the technology. Does this action require an environmental impact study?

PRELIMINARY PROPOSED GOALS FOR NUCLEAR WASTE MANAGEMENT*

A. Goals to be Achieved During the Period of Active Use of Nuclear Power

• MAKING EXISTENCE OF UNCERTAINTIES EXPLICIT. The existence of scientific, technological, and organizational uncertainties in any waste management system shall be made explicit along with the logic and procedures used to address these uncertainties.

• BASING DECISIONS AND ACTIONS ON ASSESSMENT OF IMPACTS. Decisions and actions shall be based on assessments of the impacts on both present and future physical, human and societal environments. Organizational and institutional issues shall be included explicitly.

• CONSIDERING NON-QUANTIFIABLE VALUES. Values not easily quantifiable shall be actively considered in the decision process.

• INVOLVING THE PUBLIC IN THE DECISION/PLANNING PROCESS. There shall be broadly based involvement of interested groups, jurisdictions, and citizens in decisions and in the planning process.

• INVOLVING STATE, LOCAL, AND REGIONAL GOVERNMENTS. Other than Federal jurisdictions (e.g., states and local governments) shall be involved from time of inception of ideas to implementation of a waste management system.

• PUBLIC PARTICIPATION IN THE DECISION PROCESS. The decision-making process shall involve the public at large including both interested groups and individual citizens.

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* As distributed at Conference following Session II.

• ORGANIZATIONAL RESPONSES TO CHANGE THE SCALE. The organizational infra-structure shall be able to respond successfully to both gradual and abrupt changes in the rate and scale of activities.

• PROTECTING THE PUBLIC DURINC WASTE MANAGEMENT SYSTEM OPERATION. The collection, treatment, intermediate storage, and transportation of radioactive wastes shall be performed in a manner that provides reasonable assurance that the public health and safety will be protected. Procedures will be developed for assuring that any unintended incident at this stage can be dealt with adequately.

• MINIMIZING EFFLUENTS. Efforts shall be made to minimize the fraction of radioactive wastes which are dispersed in effluent streams and to channel as much of it as practical into a waste stream which can be captured and contained.

• IMMEDIATE ESTABLISHMENT OF A WASTE MANAGEMENT PROGRAM. The responsibility for establishing a waste management program shall not be deferred to future generations or to unknown technologies.

• MINIMIZING TIME BETWEEN WASTE CREATION AND DISPOSAL. The time period from generation of radioactive wastes in nuclear reactors, other nuclear facilities, or during various activities of the nuclear fuel cycle, to the time of ultimate disposition shall be minimized.

• ASSIGNING COSTS OF A WASTE MANAGEMENT SYSTEM. To the extent possible all costs of a waste management system shall be identified and the financial resource assured.

• EFFECTS OF PRESENT NEEDS ON THE NATURE OF FUTURE SYSTEMS. The need to handle, treat, and dispose of nuclear wastes already in

existence shall not dictate the nature of a solution for wastes yet to be generated.

• INDEPENDENCE OF THE WASTE MANAGEMENT SYSTEM FROM THE FUEL CYCLE. The waste management system shall be designed in such a way that its operation does not depend on the existence of the commercial nuclear power system. Other nuclear fuel cycle operations shall not impose restrictions which limit the flexibility of the waste management system.

B. Goals to be Achieved During the Period of Active Societal Involvement in Waste Management System Implementation

• ORGANIZATION AND INSTITUTIONS TO DETECT AND RECTIFY ERRORS. The organizational and institutional systems shall be designed so as to ensure detection and rectification of errors.

• INTERNATIONAL SYSTEMS CONSIDERATIONS. As the effects of radioactive waste management are global in nature, the organizational and institutional systems shall take an active part in effecting international waste management agreements and policies.

• IMPLEMENTING SYSTEMS NOT SELF-PERPETUATING. The organizational implementing systems shall not be self-perpetuating nor shall they permit waste management technologies to become ends in themselves unrelated to the needs of society.

• INDEPENDENCE FROM THE POLITICAL SYSTEM. The organizational implementing system shall not be effected by, nor require changes in the political system nor reduce the amount of democratic freedom,

such as civil liberties.

• SPECIFYING THE NORMAL STATE OF THE SYSTEM. The state of the waste management system shall be specified as precisely as possible so as to maximize the likelihood of recognizing an undesired and/or unexpected event. Institutional mechanisms shall be created that will be responsible for rectifying any errors.

• DOCUMENTATION FOR THE FUTURE. Adequate documentation of present activities and decisions to allow future generations basis for action shall be provided.

• BUDGETARY CONSIDERATIONS. Budgetary considerations should not provide a determining constraint in the development, operation, or error correction of a waste management system.

• INTERMEDIATE HANDLING AND STORAGE. The intermediate storage and handling of radioactive waste shall be performed in a manner that does not prevent subsequent treatment and handling for ultimate disposition.

• RETRIEVABILITY OF DISPOSED WASTES. Retrievability of radioactive wastes, with a technological base at least as advanced as present day, shall not be precluded.

C. Goals to be Achieved Throughout the Entire Period During Which the Waste Management System is Designed to Isolate the Wastes from the Human Environment.

• STABILITY OF SOCIAL AND GOVERNMENTAL INSTITUTIONS. The waste management system shall not require stability of social and governmental institutions for its secure and continued operation.

• COMPLIANCE TO RADIATION STANDARDS. Waste management systems shall comply with all radiation standards, criteria, and regulations established to cover both normal operations and accident situations. The system shall be capable of meeting the criteria in all conceivable incidences of radiological releases.

• DECONTAMINATION/DECOMMISSIONING OF NUCLEAR FACILITIES. To avoid the possibility of proliferating radioactive waste sites throughout the country, no nuclear facility shall be licensed that at the end of its operating life cannot meet decontamination standards, or be dismantled and physically removed from its original site to a waste disposal site.

• SITING AND OPERATION OF WASTE DISPOSAL FACILITY. The siting and operation of a waste disposal facility shall be done to avoid as much as possible foreclosure of future options.

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