

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

IN THE MATTER OF)
PROPOSED RULEMAKING ON THE STORAGE)
AND DISPOSAL OF NUCLEAR WASTE) PR-50,51 (44 FR61372)
(Waste Confidence Rulemaking))

CROSS-STATEMENT
OF THE
UNITED STATES
DEPARTMENT OF ENERGY
WASHINGTON, D.C. 20545

5 September 1980

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* POOR QUALITY PAGES

ERRATA FOR
CROSS-STATEMENT
OF THE
UNITED STATES
DEPARTMENT OF ENERGY
PR-50, 51 (44 FR 61372)

<u>Page No.</u>	<u>Correction</u>
I-8	Para. 2, line 4, delete (NRDC).
II-54	Para. 2, line 3, delete the first "the".
II-77	Para. 1, line 4, change "safety" to "safely".
II-128	Para. 4, last line, change "affect" to "effect".
II-131	Para. 2, line, 7, change "phenomena" to "phenomenon".
II-133	Para 3, line 2, change "media" to "medium".
II-159	II.D.1, Para. 3, line 3, delete "to".
III-14	Para. 5, last line, change the second "on" to "or".
B-9	Last line, change "II.A.4-1" to "II-18".
Note:	Pages identical to B-9 should appear immediately following B-4 and B-13.
B-33, B-34	Should be the first two pages of Appendix C.
C-4	Should immediately follow C-1.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

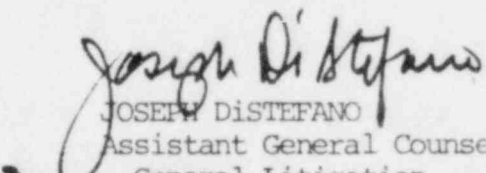
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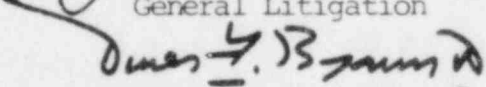
CROSS-STATEMENT OF THE
UNITED STATES DEPARTMENT OF ENERGY

Pursuant to the procedural orders issued by the Presiding Officer,
the United States Department of Energy herewith files its Cross-Statement in the
above-entitled rulemaking proceeding.

Respectfully submitted,

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I. INTRODUCTION

I.A ORGANIZATION AND CONTENT OF CROSS-STATEMENT

The United States Department of Energy (the Department or DOE) is filing this Cross-Statement pursuant to the procedural orders issued by the Presiding Officer appointed by the United States Nuclear Regulatory Commission (the Commission or NRC) to monitor the early stages of this rulemaking proceeding and to assist the Commission in conducting the later portions (1).

This Cross-Statement discusses the various issues raised in the Statements of Position filed by other Participants in this proceeding following the submission of the Department's Statement. A list of the other Participants that have submitted Statements and the citations used in referring to them appears in Table I-1.

The Department's Statement of Position was filed and served on each Participant on 15 April 1980. Additionally, the Department (by letter dated 18 January 1980) previously had submitted to the Commission a computer list of approximately 11,922 references and abstracts on waste storage and disposal. The Department also forwarded to the Commission copies of hundreds of the references cited by the Department for the use of the Commission and for placement in the Commission's Public Document Room in Washington, D.C. Copies of approximately 130 often-cited core documents were placed in the Department's 10 regional offices and the Commission's Public Document Room for the use of the Participants in this proceeding.

In its Statement, DOE PS at I-4, the Department submitted that it is its position that:

1. Spent nuclear fuel from licensed facilities ultimately can be disposed of safely off-site.
2. Disposal facilities will be in operation between 1997 and 2006, and the initial increment of off-site storage facilities can be in operation by 1983.
3. Spent nuclear fuel from licensed facilities can be stored safely either on-site or off-site until disposed of ultimately.

Table I-1. List of Statements of Position and Citation Form
Used in This Cross-Statement

<u>Citation</u>	<u>Participant and Date of Position Statement</u>
AICHe PS	American Institute of Chemical Engineers (6/23/80)
ANS PS	American Nuclear Society (7/3/80)
AEG PS	Association of Engineering Geologists (8/1/80)
AIF PS	Atomic Industrial Forum, Inc. (7/7/80)
Bech PS	Bechtel National, Inc. (7/3/80)
CDC PS	California Department of Conservation (7/7/80)
CEC PS	California Energy Commission (7/7/80)
CPC PS	Consumers Power Company (7/11/80 - One-page letter)
DE PS	State of Delaware (7/3/80)
DOE PS	U.S. Department of Energy (4/15/80)
ECNP PS	Environmental Coalition on Nuclear Power (7/80)
GE PS	General Electric Company (7/1/80)
IL PS	State of Illinois (7/7/80) (includes Roy affidavit)
Lewis PS	Marvin I. Lewis (7/10/80)
Lochstet PS	Dr. William A. Lochstet (7/3/80)
MN PS	State of Minnesota (7/8/80)
MAD PS	Mississippians Against Disposal (6/25/80)
NECNP PS	New England Coalition on Nuclear Pollution (7/7/80)
NFE PS	Neighbors for the Environment (7/4/80) (includes papers by Rae, Dornsife and Strahl)
NRDC PS	Natural Resources Defense Council, Inc. (7/7/80)
NY PS	State of New York (7/7/80)
OC PS	Ocean County and Township of Lower Alloway Creek (7/10/80)
OH PS	State of Ohio (7/7/80)
SC PS	State of South Carolina (7/3/80)
SE2-CN PS	Scientists and Engineers for Secure Energy, Connecticut Chapter (7/1/80)
SHL PS	Safe Haven, Ltd. (7/7/80)
SMP PS	Sensible Maine Power, Inc. (7/7/80)
TVA PS	Tennessee Valley Authority (7/7/80)
UNWGM-EEI PS	Utility Nuclear Waste Management Group-Edison Electric Institute (7/7/80)
USGS PreS	United States Geological Survey (4/15/80)
USGS PS	United States Geological Survey (7/7/80)
VT PS	State of Vermont (7/1/80)
WN PS	State of Wisconsin (7/10/80) (includes comments by Mudrey, Leverance, Kelly and Deese)

The other Participants have had ample opportunity to review and comment upon the Department's position and the extensive body of publicly available information on which it is based. The Statements of Position of other Participants were due on 7 July 1980.

The Department has performed a detailed review of all the Statements of Position filed by the other Participants. Following a brief discussion of the scope of this proceeding and the standard the Commission should apply in reassessing its "confidence" in the management of spent nuclear fuel from licensed facilities, this Cross-Statement (in Part II) addresses, issue-by-issue, each of the program and technical issues raised in the other Participants' Statements.* Some Participants have supported the Department's position. Others have attempted to challenge some of the bases for it. No Participant has demonstrated any reason for the Commission not to find reasonable assurance for adopting the Department's position. A summary of the specific issues raised by the other Participants and the Department's response to each appears in Chapter III.A.

For the reasons demonstrated below, the Department reiterates that there exists an adequate overall waste management program capable of handling, storing, and disposing of spent nuclear fuel from commercial power reactors. The other Participants have not shown that disposal and storage facilities cannot and will not be made available when needed. The Commission therefore should determine (for the reasons described in more detail in Chapter III.B) that the issue need not be considered in individual NRC licensing proceedings.

I.B SCOPE OF THE PROCEEDING

Some Participants have attempted to raise issues outside the scope of this rulemaking or have made premature suggestions about procedures the Commission should use during the remainder of this proceeding. The issues

*In their Statements of Position, a few Participants raised several specific questions about particular passages in the Department's initial Statement. These are addressed in Appendix A of this Cross-Statement.

the Commission faces in this rulemaking are what will be the disposition of spent nuclear fuel stored at the sites of operating power reactors and how questions about such disposition should be addressed in individual NRC licensing proceedings. See 44 Fed. Reg. 61,372 (1979) (DOE PS, Ref. I-1). The Department prepared its Statement of Position, which was filed on 15 April 1980, pursuant to the First Prehearing Conference Order issued by the Presiding Officer on 1 February 1980. In that Order, the Presiding Officer sustained the Department's position that this proceeding should consider, as the representative case for handling high-level nuclear wastes, disposal and storage of spent nuclear fuel taken directly from commercial power reactors.* The Presiding Officer also ordered that issues of low-level waste, uranium mill tailings, and the safety of transportation of waste materials are not within this proceeding's scope.

Despite the fact that the Presiding Officer's Order was unchallenged at the time, at least two Participants now criticize the "narrow" scope of the Department's Statement of Position and of this proceeding itself. NECNP PS at 44-47; WN PS, Deese at 6-10. Some Participants attempt to raise sweeping questions about the safety of transportation of waste materials. MAD PS at 2; NY PS at 94-95, 103-104; NECNP PS at 46-47. See also CEC PS at 26-27; DE PS at 5; SHL PS at 2-3; OH PS at 14. Several Participants interject issues concerning reprocessing and disposal of waste forms other than spent fuel. AIChE PS at 3; AIF PS at 2; Lewis PS at 6; SE2-CN PS at 7; NRDC PS at 21, 86; MN PS at 7; MN PS, Abrahamson at 13, 28; NECNP PS at 45, 47-48, 75; OH PS at 6; CEC PS at 51-52; CDC PS at 7-8; WN PS, Mudrey at 5, 11; WN PS, Deese at 6; Bech PS at 6. Two Participants also address issues concerning foreign or defense-related nuclear waste activities. NRDC PS at 75-76; CEC PS at 24. The Department submits that these comments are an untimely and inappropriate attempt to reopen procedural matters concerning the scope of this proceeding. That scope already has been defined. The Department therefore will not address these comments further in this Cross-Statement.

*In presenting its assessment of confidence in the ability to store and dispose of spent fuel in its Statment of Position, the Department noted that it was in no way suggesting a judgment of the potential suitability or nonsuitability of other techniques (such as reprocessing) for treatment and disposal of radioactive wastes. See DOE PS at I-2, I-5.

Suggestions about procedures to be followed during the remainder of this proceeding are offered by two Participants. The New England Coalition on Nuclear Pollution repeats its position that the Commission should take "affirmative steps" to solicit the views of persons not participating in this proceeding, but the Coalition does not identify what matters it believes are in controversy. NECNP PS at 2-3. See also ECNP PS at 2; OC PS at 20. Participant Lewis has suggested that the Commission ". . . hold a few public workshops or meetings to get the flavor of the public into the record." Lewis PS at 2. Both of these recommendations still are premature at this early stage of the proceeding for the reasons stated by the Commission in its Memorandum and Order of May 28, 1980, defining the role of the NRC Staff in this proceeding and reiterated by the Presiding Officer in his Order Extending Time to File Statements and Cross-Statements of Position (May 29, 1980) at 2-3. Following the submission of these Cross-Statements, all Participants have been ordered to file suggestions as to the nature and scope of further proceedings, additional areas of inquiry, or further data or studies. If they can show grounds, NECNP and Mr. Lewis should renew their suggestions at that time.

I.C THE STANDARD FOR DETERMINING "CONFIDENCE"

As noted in the preceding portion of this Cross-Statement, the issues the Commission faces in this rulemaking are what will be the disposition of spent nuclear fuel stored at the sites of operating power reactors and how questions about such disposition should be addressed in individual NRC licensing proceedings.* Throughout its Statement of Position and this

*The Commission has defined the scope of this rulemaking as follows:

The purpose of this proceeding is solely to assess generically the degree of assurance now available that radioactive waste can be safely disposed of, to determine when such disposal or off-site storage will be available, and to determine whether radioactive wastes can be safely stored on-site past the expiration of existing facility licenses until off-site disposal or storage is available (2).

Cross-Statement, the Department has convincingly demonstrated that it has a nuclear waste management program capable of handling, storing, and disposing of spent nuclear fuel from commercial power reactors. Some Participants have discussed the degree of proof the Commission should apply in making this generic assessment. The Commission already has indicated that any final rule resulting from this proceeding will have to be based upon a finding of "reasonable assurance" that the facts underlying that rule are true. In the Notice of Proposed Rulemaking announcing this proceeding, the Commission said:

If the Commission finds reasonable assurance that safe, off-site disposal for radioactive wastes from licensed facilities will be available prior to expiration of the facilities' licenses, it will promulgate a final rule providing that the environmental and safety implications of continued on-site storage after the termination of licenses need not be considered in individual licensing proceedings (3). (Emphasis added.)

The Department submits that it is appropriate that the Commission apply the "reasonable assurance" standard in this proceeding. Suggestions by a few Participants that the Commission should apply a different standard should be rejected. This rulemaking, it must be recalled, was initiated by the Commission in response to the decision of the United States Court of Appeals for the District of Columbia Circuit in State of Minnesota v. NRC (4).* The court specifically declined to dictate the procedures to be followed in this proceeding. In doing so, the court, however, said:

The breadth of the questions involved and the fact the ultimate determination can never rise above a prediction suggest that the determination may be a kind of legislative judgment for which rulemaking would suffice (5). (Emphasis added.)

*The court therein remanded two licensing actions to the Commission to consider whether an off-site storage solution for nuclear wastes will be available by the expiration dates of the operating licenses of the Vermont Yankee and Prairie Island nuclear power plants, to which the Commission had granted permits to increase on-site spent-fuel storage facilities, and, if not, whether spent fuel can be stored at the sites past those dates and until an off-site solution is available. The court did not set aside or stay the challenged license amendments.

Additional guidance on the standard to be applied by the Commission is provided by Judge Tamm's concurring opinion in the same case. He said:

Specifically, there must be a determination whether it is reasonably probable that an off-site fuel repository will be available when the operating license of the nuclear plant in question expires (6). (Emphasis added.)

Judge Tamm added:

Our opinion merely remands this case to the Commission for such proceedings as it deems appropriate to determine whether there is reasonable assurance that an off-site storage solution will be available when needed--in this case, by the years 2007-2009 (7).

Other Participants apparently agree that the Commission should use the standard of "reasonable assurance" as the basis for a finding of "confidence" in the safe and timely implementation of proposed disposal and storage programs. See, e.g., NECNP PS at 9-13; OC PS at 5; UNWGMG-EEI PS, Doc. 2 at I-2. However, full agreement as to what constitutes "reasonable assurance" does not exist. Cf. ECNP PS at 3 (suggesting the need for an "extraordinarily high degree of assurance"); and NY PS at 26-27 (suggesting that the Commission must have "the highest degree of confidence"). The latter suggestions go beyond the "reasonable assurance" standard which requires that findings be based upon sound judgment, but not extraordinary or absolute certainty.

The Department submits that using the "reasonable assurance" standard proposed by the Commission is appropriate, because it will ensure compliance with the "substantial evidence" standard, the standard established by the Administrative Procedure Act (APA) for rulemaking proceedings. The APA requires that a rule be supported by "substantial evidence" (8). Use of the "reasonable assurance" standard thus is a proper exercise of the Commission's discretion to formulate procedures for making substantive judgments in rulemaking proceedings both because it is in compliance with the APA and because the courts previously have upheld Commission decisions based upon it (9).

One Participant says that the Commission should vote for no confidence, if the weight of evidence tips only slightly toward confidence. NY

PS at 40-41. This suggestion by the State of New York would virtually amount to using the standard of "beyond a reasonable doubt" applied in criminal prosecutions. Use of that standard also has been suggested by the California Department of Conservation, CDC PS at 5, but that would be inappropriate in an NRC rulemaking. Neither the Atomic Energy Act of 1954, as amended, nor the Commission regulations require totally risk-free actions (10). Absolutely risk-free actions are similar to other absolute positions and arguments that have been rejected by the courts (11). See also UNWVG-EEI PS, Doc. 1 at I-2. They should not form the basis for the Commission's actions in this rulemaking.

The Commission also should reject suggestions that a finding of "confidence" requires extrasensory perception, as the Natural Resources Defense Council and the State of Ohio intimate. NRDC argues that to say that safe storage (NRDC) will occur ". . . requires clairvoyance, with which neither the DOE nor the NRC is equipped." NRDC PS at 93. The State of Ohio expresses a concern that various institutional problems render any attempt to forecast the date for the operation of the system, which it admits is technically feasible, ". . . to be little more than an attempt at clairvoyance without the benefit of a crystal ball." OH PS at 3. It is absurd to suggest that the Commission cannot find confidence in the safe and timely implementation of proposed disposal and storage programs unless it is endowed with superhuman powers. If such a standard were required to be the basis for administrative actions, no decisions could be reached or actions taken.

The Commission must base a finding of confidence on an informed but a mortal prediction of germane technical and program matters. The effectiveness of long-term disposal, unlike the effectiveness of other industrial activities, such as novel power generation techniques, cannot be demonstrated to the degree some have suggested. Cf. ECNP PS at 3. As another Participant points out, such demonstration would require observation of the repository over the time period during which wastes remain hazardous. UNWVG-EEI PS, Doc. 3 at 1-3. Because the periods of concern are lengthy, means other than observations over hundreds or thousands of years must be used to evaluate the safety of proposed disposal systems.

NECNP argues that the Commission must establish criteria to govern the degree of assurance required for a finding of "reasonable assurance." NECNP PS at 9-13. The Department reiterates its position that the

high-level waste disposal system objectives proposed in its initial Statement, DOE PS at II-3 to II-21, provide an appropriate basis for assessing in this proceeding the technical adequacy of the Department's disposal program and of the systems that will result from its implementation. By contrast, the Commission can measure its confidence in the safety of interim storage on the basis of existing regulations. See DOE PS at IV-2 to IV-4. With respect to assessing program plans, which require predicting the future course of human activities, the Commission should determine whether acceptable measures will be taken on a timely basis.* Findings of confidence in each of these matters should be made by the Commission when there is "reasonable assurance" in favor of such finding.

One Participant alleges that the Department's program does not meet the standards established by the Commission for the issuance of either an operating license or a construction permit for a power plant (and therefore the Commission should not find confidence in the program). NRDC PS at 16-19. See also SHL PS at 1, 6-7. This allegation mischaracterizes the issue before the Commission in this generic rulemaking. The Department in this proceeding is not applying for authority to construct or operate a particular disposal or storage facility. The Commission is conducting this rulemaking to make a generic judgment that is largely legislative in nature.

In making its findings in this proceeding, the Commission should be careful to avoid devoting undue attention to sweeping and unsupported contentions about critical "gaps" in technical knowledge or allegations that program difficulties never will be overcome. Unsupported allegations should not give rise to presumptions. The Supreme Court of the United States

*The thrust of the Position Statements of some Participants is that the Commission should concentrate its inquiry on whether disposal will be accomplished as opposed to whether it can be. See, e.g., NY PS at 15-17; MN PS at 4; Lewis PS at 2; NRDC PS at 9-10. (NRDC in fact concedes, "No informed commentator has claimed that it is now and will continue to be impossible to isolate or contain high-level radioactive wastes. No laws of physics must be violated to produce a waste disposal program." Id. See also OH PS at 3.) The Department submits that its Statements in this proceeding demonstrate that (i) the techniques proposed to be used for disposal and storage will be safe and (ii) they will be implemented in a time frame that is responsive to national needs.

in Vt. Yankee Nuclear Power v. Natural Res. D. C. (12) indicated that it is incumbent upon participants in administrative proceedings to structure their participation so that it is meaningful and so that it alerts the agency to the participant's position and contentions, especially when (as herein) they are requesting the agency to embark on an exploration of uncharted territory.

In summary, the Commission should make a finding of "confidence" in the safe and timely implementation of proposed disposal and storage programs if there is reasonable assurance in favor of that conclusion. Disputes should be resolved by choosing what seems to be the most reasonable inference. A finding of either "confidence" or "lack of confidence" in this proceeding will be of great significance, especially in this time of concern about the availability of energy resources. Therefore, the Commission should require all proponents of particular conclusions in this proceeding to provide adequate support for those conclusions. The Department submits that its Statement of Position and this Cross-Statement have more than done so.

REFERENCES FOR PART I

- (1) In the Matter of Proposed Rulemaking on the Storage and Disposal of Nuclear Waste, First Prehearing Conference Order, Docket No. PR-50,51 (NRC), February 1, 1980; Id., Order Extending Time to File Statements and Cross-Statements of Position, May 29, 1980 (DOE PS, Ref. I-4)
- (2) 44 Fed. Reg. 61372, 61373 (1979) (DOE PS, Ref. I-1)
- (3) Id.
- (4) 602 F.2d 412 (D.C. Cir. 1979) (DOE PS, Ref. I-2)
- (5) Id. at 417
- (6) Id. at 419
- (7) Id. at 420.
- (8) 5 U.S.C. 556(d)
- (9) See, e.g., New England Coalition v. Nuclear Regulatory Commission, 582 F.2d 87, 93 (1st Cir. 1978); No. Anna Env. Coalition v. Nuclear Regulatory Commission, 533 F.2d 655, 665 (D.C. Cir. 1976)
- (10) Nader v. Nuclear Regulatory Commission, 513 F.2d 1045, 1050 (D.C. Cir. 1975); Nader v. Ray., 363 F.Supp. 946, 954-55 (D.D.C. 1973)
- (11) No. Anna, Supra
- (12) 435 U.S. 519, 553 (1978).

II DISCUSSION OF ISSUES RAISED IN STATEMENTS OF POSITION OF OTHER PARTICIPANTS

II.A ISSUES RELATED TO IMPLEMENTATION OF STORAGE AND DISPOSAL PROGRAMS

II.A.1 Introduction

Many Participants contend that, even putting technical problems aside, the Commission cannot find confidence in the Department's schedules for storage and disposal facilities because of unresolved issues of program implementation, sometimes referred to as "nontechnical" or "institutional" issues. Because these issues are emphasized by so many of the Participants, they are addressed before technical issues about which there generally is less disagreement.

The Department agrees that the resolution of difficult nontechnical problems is essential to the success of the waste program and that in many past instances the Federal Government has not adequately addressed these problems. In his Message of 12 February 1980; DOE PS, App. A; the President stated that resolution of nontechnical issues is as important as the resolution of the technical issues and recognized prior inadequate involvement of State and local governments in the decisionmaking process for waste management activities. More recent events demonstrate a clear recognition of these issues by concerned parties and provide examples of progress in developing the necessary processes to address them.

The Department has performed a detailed review of all of the Statements of Position filed by other Participants. In this portion of the Cross-Statement, issues related to the implementation of storage and disposal programs are discussed. The following sections describe the actions of the President to formulate a national policy with broad input from multiple institutions and the public, the establishment of the State Planning Council, and numerous examples of joint Federal-State discussions and agreements. Also discussed are the Department's management structure and schedules as well as the impacts of regulatory uncertainties, socioeconomic factors, public opposition, and costs. The Department does not claim that all issues are resolved

today but maintains that adequate activities are now under way to permit completion of the schedules described in the Position Statement.

II.A.2 Ability of Legislative and Executive Branches to Resolve Pertinent Issues

Several Participants note that there remain to be resolved at the Federal level major issues affecting the design and implementation of a national waste program. They question the ability of the Legislative and Executive Branches to resolve these issues. Some believe that legislation is necessary for this resolution and that this legislation will not be forthcoming, either because of inadequate cooperation between the Executive and Legislative Branches or because of an inability of Congress to reach a consensus on legislation. Others seem to think that this resolution cannot be depended upon because of the potential for major policy shifts from President to President.

II.A.2.1 Timely Passage of Necessary Legislation

Four Participants question whether there will be sufficient cooperation between the Legislative and Executive Branches to put in place necessary legislation to implement the national waste management program. To support claims that the current levels of cooperation are inadequate, they cite proposed Congressional bills allegedly at odds with the policies of the Administration, Congressional disagreements on the Department's funding requests, and other disagreements between the President and Congress as reflecting a situation of uncertainty and institutional chaos. NRDC PS at 76 to 78; CEC PS at 20 to 23; CDC PS at 7; OH PS at 6 to 8. There now are and will continue to be differences between Congress and the Executive Branch with respect to legislative approaches and funding requirements. The Department maintains, however, that these differences are well within traditional bounds, have been resolved in the past, and will continue to be resolved in the future. Meanwhile, the Department's waste management program is proceeding under applicable legislative authority.

Because our form of government is based on a concept of "separation of powers" which provides for "checks and balances," there are bound to be disagreements between the President and Congress, particularly in the early stages of the development of a coherent and comprehensive national policy that reflects a national consensus. Considering that there are any number of approaches that could be workable, the Department submits it is appropriate that the elected leadership consider a variety of options prior to selecting one.

In any case, there does not appear to be a conflict between the President and Congress on the goal of a waste management program. Both are striving for providing interim storage capacity and for demonstrating disposal capability. Furthermore, the President and Congress have expressed support for mined geologic disposal as an interim strategy while alternative concepts are being studied. In the 12 February 1980, Message to Congress, DOE PS, App. A, the President specifically stated that he is ". . . adopting an interim planning strategy focused on the use of mined geologic repositories." Similarly, a major aspect of S.2189, the Nuclear Waste Policy Act, which was passed in the Senate on 30 July 1980, relates to mined geologic repositories. The dramatic increase in funding for the commercial waste management program from \$14 million in FY 1976 to \$219 million in FY 1980 demonstrates basic agreement between the Executive and Legislative Branches. In regard to assigning management responsibility for developing and implementing the technology, Congress and the President have both agreed that the Department of Energy has the lead role. Similarly, both the President and Congress have recognized the need to establish an institutional framework to involve State and local governments in the decisionmaking process. Toward this end, the President has created by Executive Order a State Planning Council to advise the Executive Branch and to work with Congress in making and implementing decisions on waste management and disposal. DOE PS, App. A. Legislation is under active consideration in the Congress to provide a statutory basis for the Council.

The other major reason that Participants cite as a basis for questioning whether necessary legislation will be forthcoming in a timely fashion is an alleged inability of the Congress itself to reach consensus regarding the statutory framework for the implementation of a waste disposal program. OH PS at 8; CEC PS at 23. The California Energy Commission specifically states, "As many as two dozen separate committees and subcommittees in

the two houses of Congress are working at cross purposes or in direct conflict." CEC PS at 23. The California Energy Commission also says that more than 40 bills are pending, many of which reveal major differences in approach, and most of which conflict with Presidential policy.

It is true that a multitude of legislative proposals on nuclear waste management was introduced during the 96th Congress. There have in fact been approximately 70 bills introduced that address nuclear waste management issues. These bills include Department of Energy authorization bills; bills dealing with nuclear energy, which include language regarding nuclear waste; nuclear transportation bills; bills defining the roles of States in siting waste facilities; bills which would establish demonstration repository programs; and bills that would set other specific requirements on the nuclear waste management program. Contrary to some Participants' assertions that this level of activity is evidence of instability and confusion, the Department submits that the number of such proposals now before the Congress is indicative of Congressional intent to consider a variety of divergent views before a more precise definition is developed. Consequently, the multitude of bills should be viewed positively, as representing the active participation of a broad spectrum of interests. Other Participants agree. SE2-CN PS at 21; AIF PS at 33. These Participants reason that such actions are responsible initiatives on the part of the Federal Government and demonstrate that the political will exists to overcome remaining obstacles. Id.

An examination of the bills in Congress reveals that all the bills are oriented toward development of a solution for waste disposal. In many instances the bills are also structured to provide mechanisms for involving States in the siting process and allowing full disclosure to and participation by the public and technical community.

From the above discussion, the following conclusions can be made. First, despite the extensive debate on the question of nuclear waste, the Congress and the Executive Branch agree on major issues. These are (i) a permanent solution is required, (ii) mined geologic disposal should be the interim strategy, and (iii) the need exists to establish an institutional framework to involve State and local governments in the decisionmaking process. Second, a multitude of bills now addressing nuclear waste must be recognized as the means by which our system of government obtains a broad

spectrum of views. The end result is the timely passage of necessary legislation. Finally, there, in any case, is sufficient programmatic and technical flexibility to accommodate the final approach chosen.

II.A.2.2 Continuity of Policy From One Administration to the Next

Some Participants question the ability of the Executive and Legislative Branches to resolve major issues because of a potential lack of continuity in policy positions among Presidents. OH PS at 6; CDC PS at 7. There is some potential for policy shifts from President to President, but the Department does not believe this to be a credible deterrent for a finding of confidence. Although refinements or minor modifications may be expected to occur, radical departures from an existing national policy cannot occur without deliberation on the part of both Congress and the President. If it is determined by both Branches of the government acting under their Constitutional authority that it is in the national interest that major departures from past practices are necessary, then policy positions will be developed consistent with the needs at that time. The guarantee sought by the State of Ohio and the California Department of Conservation that policies have to be fixed forever is not achievable, nor should it be.

Further, it is unlikely that a new Administration would attempt to change the basic structure and goals of an ongoing program that has already been structured in response to prior widespread and prolonged public policy debate and resolution. The formulation of a comprehensive waste management program described by the President on 12 February 1980 incorporated input from 14 Federal agencies, from State and local governments, from public interest and environmental groups, and from industry. Over 3,300 written comments were received on the draft Interagency Review Group Report alone. The national waste management plan currently being prepared will receive similar distribution and public review and will be shaped according to the combined input of interested and concerned individuals and institutions of society. In addition, as previously discussed, very active participation by multiple committees of the Congress is resulting in formulation of policies that, for example, in the case of recent Senate action on S.2189 (a vote of 88 to 7), are receiving bipartisan approval. To suggest that election of a new President

and definition of new policies will result in significantly different program strategy is to suggest that the opinions from all other national institutions that have helped form the original policy will simultaneously change. The Department does agree that some aspects of its program might be redirected, but submits that the national consensus on the responsible disposition of radioactive wastes will transcend Presidential elections.

In summary, the Department submits there is ample evidence that major national programs can and usually do maintain continuity over a large period of time.

II.A.3 Coordination With Other Federal Agencies

Several Participants have pointed out that there are multiple Federal agencies involved with the implementation of the nuclear waste program. They believe that problems will arise, as a result, which will deter effective and timely decisionmaking, thus affecting confidence that a disposal system will be available within the indicated time frame. The problems cited relate both to the roles assigned to the various agencies and to the adequacy of mechanisms for coordinating the various agencies' activities resulting from these roles.

With regard to the roles assigned to the various agencies, the State of Wisconsin notes that Federal responsibility for nuclear waste management has changed from a highly centralized Atomic Energy Commission (AEC) to a complex balance among many agencies. WN PS, Deese at 5. The State of Ohio expresses concern that the function of each agency may be unclear, and asks that the Department delineate each agency's waste management functions. OH PS at 9 to 11.

The roles of multiple Federal agencies participating in the program already are discussed at length in the Department's Statement of Position. DOE PS at III-31 to III-34, III-42 to III-48. The involvement of multiple Federal agencies brings to the nuclear waste management program the specialized knowledge, skills, and other resources that only those specialized agencies can provide. As indicated by the State of Wisconsin, the number of departments and agencies involved in the waste management issue is beneficial to the extent that it broadens the fields of expertise and overall experience

of people participating. WN PS, Deese at 5. Put another way, almost any problem of such complexity is inevitably factored into manageable pieces. If one agency were given the entire assignment, it would doubtless have to create internal subunits reflecting the diversity of separate organizations now involved.

A concern expressed by the State of New York is that agencies may disagree with each other and fail to cooperate in working toward a common goal. Specifically, the State of New York alleges that (i) the Department cannot assume that the Bureau of Land Management (BLM) will make lands available for exploratory work (repository testing); (ii) the Department of the Interior (DOI) opposes siting a repository on or adjacent to other lands subject to its jurisdiction ". . . such as portions of the National Park System, the Wild and Scenic River System, and the National Trail System, as well as Indian Trust Lands"; and (iii) the Department erroneously assumes that the Congress and DOI would allow withdrawal of land. NY PS at 75. Contrary to these claims, the Department of the Interior has not expressed opposition to a repository on any Federal lands but just on some classes of Federal land. The DOI has urged that the Department give potential environmental impacts their full consideration as required by law. As a result of its review of the Draft Environmental Impact Statement for the Management of Commercially Generated Radioactive Waste; DOE FS, Ref. II-34; the Department of the Interior stated that:

The final statement should delineate willingness to minimize environmental impacts which may be precipitated by the proposed action on the nation's cultural, natural and recreation resources.

* * * *

The final GEIS should include clear, coherent identification and analysis of the environmental impacts which may be reasonably expected to disturb or affect the nation's cultural and natural and recreation resources.

* * * *

The final statement should stress that the interim storage, permanent storage, and transport of commercial radioactive wastes will be carried out in a manner that has no potential for adversely affecting units of the National Park System, The Wild and Scenic River System, and the National Trail System.

* * * *

At present we favor the exclusion of such activities from areas which could affect Indian trust lands (1).

In other words, the Department of the Interior simply stressed, and the Department of Energy agrees, that environmental impacts should be identified and minimized. The contention of the State of New York that the comments of the DOI with regard to the Environmental Impact Statement indicate an opposition to the program are clearly without basis.

The Department does not expect that the Department of the Interior or Congress would allow withdrawal of public land without meeting all applicable standards. It does expect that, when all applicable and environmental safety standards are met, withdrawal would be approved by the Department of the Interior and Congress.

Three Participants characterize the overall Federal decision-making process as a disorganized "proliferation of decision makers" and allege that mechanisms are lacking to coordinate the agendas, schedules, and policies among the many departments. NRDC PS at 72; CEC PS at ii, 20-21; OH PS at 9. This alleged lack of adequate coordinating mechanisms is generally implied or cited as a reason for not having confidence that the waste program will be implemented in a timely manner. To support this claim, the California Energy Commission alleges that there has been substantial dissension in the past among Federal agencies. CEC PS at ii. Similarly, it is claimed that one agency's inability to perform a critical function could slow the entire effort. The State of Ohio specifically expresses concern over the impact on the Department's schedule caused by the involvement of numerous agencies and asks that the Department specify the amount of delay to the overall schedule that could result from problems incurred by any one agency. OH PS at 9 to 11.

The mechanisms established for interagency coordination and cooperation, such as memoranda of understanding and interagency working committees, are addressed in the Department's Statement of Position. DOE PS at III-42 to III-48. For example, the U.S. Geological Survey (USGS) has participated with the Department in developing an Earth Sciences Technical Plan; DOE PS, Ref. III-55;* which defines the technical efforts required for site identification and characterization, rock mechanics, repository sealing, waste/media interaction, and repository performance assessment. In support of the National Waste Terminal Storage (NWTs) Program, USGS is involved in geological/hydrological site characterization activities in the States of Mississippi, Louisiana, Utah, Nevada, and Washington. DOE PS at III-45. It is also involved in technological studies related to earth sciences.

The cooperative effort with the Bureau of Land Management consists of issuance of permits on certain Federal lands where the Department of the Interior has the oversight and control responsibilities. DOE PS at III-46. An example of BLM's involvement in the site exploration activities is the recent ongoing reviews for issuance of permits to conduct additional field exploration activities in Utah. The Corps of Engineers is cooperating with the Department in acquiring access to private land for exploration purposes in the State of Louisiana. DOE PS at III-47. The U.S. Department of Agriculture has cooperated in acquiring access to National Forest lands in Mississippi for conducting exploratory work. DOE PS at III-47. Furthermore, the Department also notes that the President has specifically addressed the Federal management structure necessary to facilitate coordination and cooperation, as a key element of his policy statement. As stated in the White House release of 12 February 1980:

The President has designated the Secretary of Energy to be responsible for overall program integration and to establish necessary, coordination mechanisms. The Secretary of Energy will assume the lead role for:
1) coordinating all Federal nonregulatory aspects of

*This reference is one of the approximately 130 often-cited core documents that were placed in the Department's 10 regional offices and the Commission's Public Document Room for the use of the Participants in this proceeding.

radioactive waste management; 2) working out effective relationships with regulatory bodies such as the Environmental Protection Agency and the Nuclear Regulatory Commission; and 3) developing strong and effective ties between the Federal government and the states on all aspects of radioactive waste storage and disposal.

In accordance with this charge, the Department, in cooperation with other Federal agencies, is currently preparing a comprehensive National Plan for nuclear waste management that will integrate the schedules and specific actions of the various agencies involved. A draft plan will be submitted for public and Congressional review in late 1980. A revised plan that includes public comment will then be issued in 1981 and updated biennially thereafter.

There are other instances of interagency cooperation that may be examined. For example, the Interagency Review Group (IRG) is discussed in the Department's Position Statement. DOE PS at II-7. The need for involving and incorporating the views of the involved government agencies, as well as the Congress, the States, local governments, industry, the scientific and technical community, and other members of the public, was recognized by the President on 13 March 1978 when he established the IRG. The collective efforts of the IRG resulted in a report to the President which formed the basis for his 12 February 1980 Message to Congress. DOE PS, App. A. Such evidence of successful past multiple-agency involvement in the development of national policy should provide further assurance that similar cooperative effort will be forthcoming in the implementation of the program. In accordance with the President's direction, the Department has established an Interagency Working Committee on Radioactive Waste Management. The composition and goals of this committee are discussed in the Department's Statement of Position. DOE PS at III-43. This committee meets as necessary to address issues arising in the coordinated implementation of the President's waste management policy. Four meetings have been held since the formation of the group in late 1979; the most recent meeting was held on 5 August 1980.

In conclusion, the Department does not share the pessimistic view offered by those Participants who allege that coordination of multiple Federal agencies does not, will not, or cannot take place. Evidence of

successful coordination exists, and steps to further improve such mechanisms are being taken. Furthermore, the participation of such multiple agencies, as described in the Department's Position Statement and this Cross-Statement, is a desirable and necessary attribute that ensures consideration of diverse viewpoints.

II.A.4 Viability of Intergovernmental Decisionmaking Process

This section addresses those issues raised by Participants regarding the ability of the Federal Government to effectively include State and local governments in the decisionmaking process for disposal of nuclear waste.

II.A.4.1 Role of State and Local Governments in the Decisionmaking Process

Several Participants question the Federal Government's commitment to give State and local governments an appropriate role in the decisionmaking process. These Participants contend, for example, that (i) premature releases through newspapers; WN PS, Kelly at 4; (ii) exclusion of non-government representatives from the State Planning Council; CEC PS at 23; and (iii) the Department's allegedly greater interest in persuading States to accept its plan than in incorporating States' needs; OH PS at 5; all indicate a lack of intent by the Federal Government to give State and local governments a role in the decisionmaking process.

That the Department is fully committed to giving State and local governments an important role in the decisionmaking process is evidenced by several items. The President, in his Message to Congress of 12 February 1980; DOE PS, App. A; committed the Federal Government to working with State, Tribal, and local governments in the siting of high-level waste repositories. Under the evolving framework of consultation and concurrence, the host State will have a continuing role in Federal decisionmaking on the siting, design, and construction of a high-level waste repository. The Department reaffirmed this commitment and elaborated the essential elements of the consultation and concurrence process in a letter from Assistant Secretary Cunningham to the

Governors of each of the 50 States (with copies to State Senate and House leaders) and to leaders of Tribal governments. These letters appear in Appendix B of this Cross-Statement. By 22 August 1980, replies to these letters had been received from officials of 13 states. The replies also are included in Appendix B. The Governor of Minnesota's reply did not indicate any dissatisfaction with the notification procedure. The States of Virginia and Tennessee acknowledged receipt and indicated that appropriate officials will review it. Other replies received expressed satisfaction with the stated intent of the Department to employ a notification process, as outlined in the letter. Other evidence showing that the Department is in fact living up to this commitment is discussed in the paragraphs that follow.

Participants interpret the Department's recent alleged lack of consultation with the State Planning Council prior to publication of a newspaper story regarding research plans for work in Wisconsin as an indication that the Department does not intend to involve State and local governments. WN PS, Kelly at 4; SHL PS at 3. The State Planning Council, in fact, had been provided materials describing the Department's broad intentions to expand and diversify the geologic studies supporting the identification of potential sites. It would have been outside the President's charter for the Council, and counterproductive to the function of the Council, for the Department to discuss proposed State-specific studies with the Council before doing so with affected State governments. It was realized by all the contributing architects of the Council that it could not function as an intermediary between Federal agencies and State governments and yet remain a collegial body of manageable size which could meet frequently and represent the perspectives of State, local, and Tribal governments. Furthermore, it was felt then, and still is, that the States will not yield to a committee on which they may not have any role or membership to represent their direct interests.

It is more appropriate to focus on the problem of press revelations preceding discussion with State governments. The Department indeed regrets publication of the newspaper article before having discussed the need for expanded geologic investigations with responsible State officials. This publication did not derive from any news release by the Department, as contended by Safe Haven, Ltd. SHL PS at 3. At the time of publication of the newspaper report, the Department had for some weeks been planning simultaneous

notification of several States about its interest in expanding the extent of its exploration program but had not yet developed specific proposals for investigative work. In the initial phase of consultation and concurrence, the Department will always face the dilemma of informing a State or Tribe too early (before meaningful proposals have been formulated) or too late (after the Department's potential interest has been made public). Nevertheless, the Department will strive to inform State and Tribal officials at the earliest moment that its interest in undertaking exploratory activities focuses on their jurisdiction.

Because this event occurred recently and is cited by the State of Wisconsin and by Safe Haven, Ltd., to allege a lack of intent by the Department to employ the specified process, the following letters also are attached as Appendix C of this Cross-Statement:

1. Letter, May 8, 1980 David Woodbury, State of Wisconsin, to Colin Heath, U.S. Department of Energy.
2. Letter, May 19, 1980, Colin Heath to David Woodbury.
3. Letter, May 30, 1980, Colin Heath to Ms. Mary Louise Symon, State Planning Council.
4. Letter, May 30, 1980, Gov. Dreyfus of Wisconsin, to Colin Heath, U.S. Department of Energy.
5. Letter, June 18, 1980, Colin Heath, DOE, to Gov. Dreyfus.
6. Letter, June 23, 1980, Gov. Dreyfus to Colin Heath, DOE.
7. Letter, July 10, 1980, Willie Nunnery, Wisconsin Public Utilities Commission to George W. Cunningham, U.S. Department of Energy.

Perusal of these letters will show that, despite the unintended premature publication in a Wisconsin newspaper, orderly discussion of proposed activities has been held with officials of the State of Wisconsin.

The California Energy Commission cites the exclusion of industrial, environmental, public interest, and citizen representatives from the deliberations of the State Planning Council and their alleged relegation to ad

hoc workshops, regional and area studies, and public meetings, all subject to Department of Energy discretion. CEC PS at 23. It is true that these groups are not included in the membership of the State Planning Council. However, these representatives are not excluded from deliberations of the State Planning Council, since all Council meetings are open to the public as required under the Federal Advisory Committee Act (2). The State Planning Council has been constituted as a mechanism to facilitate communication and interaction between government representatives at the Federal, State, Tribal, and local levels. The Council staff presently communicates with representatives of industrial, environmental, and public interest groups and obtains their advice and review of staff papers prepared for consideration of the Council. Furthermore, the Council is also empowered to establish review and advisory groups composed of such representatives to assist the Council in its deliberations.

The State Planning Council is not intended to be the primary mechanism to receive advice and information from industrial, environmental, public interest and citizen representatives, though it is free to seek their assistance. The Department is advised by groups constituted under the Federal Advisory Committee Act and has also established a number of standing peer review groups to provide review and oversight of various aspects of the waste management program. A compilation of such review groups and their membership is provided in Appendix D of this Cross-Statement.

In addition, the Department regularly provides for both written and oral public review of draft environmental impact statements and of other key documents prepared in the waste management program. For example, 219 written letters containing approximately 2,000 separate comments were received on the Draft EIS on the Management of Commercially-Generated Radioactive Waste. DOE PS, Ref. III-34. In addition, 2-day public hearings on this EIS were held in 5 cities as previously reported (3). Other waste management documents that have been formally circulated for public comment include the following:

1. Draft Earth Sciences Technical Plan. DOE PS, Ref. III-55.
2. Draft criteria for siting of repositories. DOE PS, Ref. III-22.

3. PNL 2955, Reference Site Initial Assessment for a Salt Dome Repository. DOE PS, Ref. II-668.
4. Summary reports of environmental and geologic characterization studies carried out in the program to identify sites (e.g., DOE PS, Refs. III-10, III-12, III-16, III-18, III-19).

In each case, documents are modified as appropriate to respond to issues raised by commentors.

Frequent other actions by the Federal Government to obtain public comment on the waste management program, including distribution of 15,000 copies of the draft report of the Interagency Review Group and analysis of 3,300 separate comments received, further point to a strong attempt by the Federal Government to obtain such input.

The State of Ohio states that the Senate Energy Committee reported out bill S.2189 with no provision for State input, implying this to be a reflection on the true intention of the Federal Government. OH PS at 7. The reference to the Senate Energy Committee report on S.2189 without provision for State input has been overtaken by Senate passage of the bill, including Title IX, which contains the definition of a very specific mechanism for providing State input to the decisionmaking process (4). While this action by the Senate on 30 July 1980 does not alone ensure establishment of this process, it clearly reflects a sensitivity to the need to provide a State role in decisionmaking by the United States Congress.

One Participant claims that the Department seems more interested in persuading States to accept its program plan than in incorporating the needs of the States into the waste management program. OH PS at 5. This claim will be clearly disproven with the passage of events. However, the discussion of existing ways in which the needs of States are currently being factored into the program provides evidence that the Department is currently moving to meet these needs. See II.A.4.2 of this Cross-Statement.

Some Participants believe that in the face of public opposition to waste repositories, the Department of Energy will eventually be forced to take legal action to impose waste repositories upon unwilling States and localities through Federal preemption. NECNP PS at 31-33; MN PS at 6. The ability of the Department to take legal action to impose waste repositories upon

unwilling States and localities is and will be governed strictly by Federal law established by the United States Congress. The Department has stated that the goal of the Administration is to provide a stable environment for decisionmaking that is sensitive to the concerns of the States, thus avoiding a formal State veto, on the one hand, and Federal fiat, on the other (5-8). Any rights of preemption held by the Department are not now clearly defined in law. The majority of bills in the area now before the Congress define a very precise process of conflict resolution employing the full powers of the National government to address issues of vital national interest.

In summary, analysis of the allegations of some Participants that the Federal Government does not have a strong commitment to provide State and local governments an appropriate role in the decisionmaking process indicates that these allegations are not supported. Not all the necessary institutional mechanisms for completing the waste management program have been defined, and many that do exist are being refined. Nevertheless, mechanisms to allow ongoing investigative work are in place, and investigative work is under way at several locations throughout the Nation. Those steps still undefined, such as the exact role of State and local governments in the final siting decision, are being vigorously addressed by the United States Congress, the State Planning Council, various State governments, and the Department of Energy. The Department therefore submits that the necessary institutional mechanisms will be in place by the time indicated for the first siting decision for a radioactive waste repository. DOE PS at III-9.

II.A.4.2 Mechanisms to Incorporate State and Local Views

Whatever the Federal commitment to involve State and local governments, some Participants believe that the Department of Energy has not established, and may not be able to establish, an adequate mechanism for incorporating State and local views. It subsequently is stated or implied that, without this incorporation, there can be no assurance that State and local concerns will be addressed, and hence the success and/or timetable for the waste management program cannot be relied upon. OH PS at 5, 12 and 13; CEC PS at 27; NY PS at 24; NRDC PS at 69.

Several Participants conclude that the Department of Energy has not adequately defined the process for involving State and local governments. OH PS at 5, 12 and 13; DE PS at 6; IL PS at 2; CEC PS 27. One Participant claims that the State Planning Council has ". . . broad, but ill-defined, responsibility . . ." for coordinating the Federal Waste Management Program with State and local interests. CEC PS at 22. One Participant urges the Department of Energy to develop detailed plans based on research and experience and suggests that the Department needs to describe how State and local concerns are conveyed to the Department and how that information will be used in the decisionmaking process. WN PS, Kelly at 4,5,6. Another Participant believes the process should provide for State and local participation at an early stage. OC PS at 18.

The Department acknowledges that the details of the consultation and concurrence process still are evolving. The State Planning Council, created by Executive Order to provide recommendations on radioactive waste management to the President and Secretary of Energy, is providing helpful advice concerning details of the consultation and concurrence process. Federal legislation, such as S.2189, may further define the process of consultation and concurrence.

However, the essential elements of the consultation and concurrence process are unlikely to change dramatically. At a minimum, this process provides for exchange of information between the State and the Department of Energy, State participation in the work to characterize sites, State advice to the Department on exploration plans, incorporation of State concerns into the Department's program, and the opportunity for the State to concur or not concur on substantive and definable issues. With the help of the State Planning Council, the Department is further identifying the specific roles to be played by State, Tribal, and local governments at each step in the process for characterizing, siting, selecting, constructing, and operating a repository site. Table II-1 reproduces a table prepared by the State Planning Council's staff for the 3 June 1980 meeting of the Council; the table represents a preliminary effort in this regard. These roles will be refined and specified in greater detail in light of the Council's advice, special needs of individual States and Tribes, final NRC licensing requirements, and new legislation that may be enacted by Congress.

TABLE II-1 Consultation and Concurrence and the Repository Siting Process *

(Note: For clarity, this chart is simplified by focusing on the host state and the federal government. Ways of including other affected states, Indian tribes, and local governments will need to be developed before a C&C process can be completely defined.)

Phase	Kind of Activity	C&C: Present Plans
1. National screening	Definition of screening criteria. Literature studies to collect information on regions that may contain candidate sites. Definition of "regions" of interest--multi-state, 1000s of sq. miles.	DOE plans to provide information to all states about its activities, including the process for finding sites and the C&C process.
2. Province/regional studies	Broad studies focusing on geologic regions, including literature surveys, field mapping, cooperation with state geologic surveys. Definition of "areas" of interest within state (100 to 1000 sq. miles).	DOE plans to consult with governors, legislators in states where it wants to work. DOE modifies its study approaches as needed. Written agreements possible.
3. Area studies	Field work, including drilling for core samples at different spots within the area. Definition of "locations" (up to 30 sq. miles). Site characterization plans submitted to NRC.	As above, plus DOE makes agreements with individual states. DOE complies with permit regulations for drilling, other activities. DOE shares research results with states, provides information to anyone interested, funds state review groups.
4. Location studies	Drilling, socioeconomic studies, environmental studies, surveys of plant and animal population, meteorological studies. Definition of specific sites (ca. 10 sq. miles).	Mostly consultation still. DOE will seek advice from states, have local presence. Fairly specific C&C agreement possible, reserving state power to concur or not.
5. Decision to proceed with detailed site characterization	DOE decides that site is ready for several million dollars and several years of work preparatory to considering it for licensing. DOE submits Detailed Site Char. Report to NRC. DOE acquires all necessary property	DOE plans appear to concentrate on next decision point (site banking), but present DOE policy would allow state to halt DOE activities at this point by objecting.
6. Detailed site characterization	DOE collects all additional data on a site necessary for a license application (including shaft excavation and at-depth testing, say proposed NRC regulations).	DOE works with state over specification and collection of additional data necessary for license application.
7. Site banking	DOE decision that a site is ready for comparison with other sites, and will be held until enough (4 to 5) sites are ready for site selection. EIS on decision on suitability for banking. DOI decision on land withdrawal.	State consent is important. Participants must reach consensus on the suitability of a site for banking, based on established technical, environmental, and institutional criteria.
8. Site selection	Selection of one site (from 4 to 5 banked sites) for license application. Preparation of Site Recommendation Report and revised EIS.	State reviews Site Recommendation Report (as do other federal agencies). When a consensus is reached, SRR is revised and issued as a Site Selection Report.
9. License application	Preparation of license application preliminary safety analysis report, and environment report for submission to NRC.	Consultation with host state.
10. NRC licensing process	NRC review of license application according to NRC regulations, and decision to authorize (or not to authorize) construction.	State-federal interaction now focuses on NRC. State role defined by NRC regulations as advisory only.
11. Repository construction	Repository construction, plus preparation of application to NRC for license to operate.	Continued consultation with state. Mitigation of local socioeconomic impacts.
12. NRC licensing process	NRC review of application to operate, and decision to grant or deny DOE a license for the repository.	State role defined by NRC regulations as advisory only.
13. Repository operation	DOE operation of repository.	Continued consultation with state.
14. Repository decommissioning	DOE applies to NRC for permission to close repository. NRC decision.	No specific state role defined by NRC regulations.

*Prepared by the State Planning Council Staff for 3 June 1980 meeting of the Council.

As described in the Department's Position Statement, the consultation and concurrence process has begun in States in which exploratory activities are already under way, such as in Louisiana, Mississippi, Nevada, New Mexico, Texas, Utah, and Washington. DOE PS at Section III-C.2.2. It is Department policy to contact the appropriate governor or Indian tribal chairman whenever a program expansion would newly involve a specific State or group of States, or an Indian nation. In this initial meeting, the Department will seek to establish appropriate consultation and concurrence procedures and explore the possibilities for cooperative studies involving Federal and State scientists. Under no circumstances will the Department begin investigations in a particular State or on Indian lands without prior discussions with State or Tribal government.

Another Participant stresses the need for uniformity in this process so that the process, which the Participant believes should be defined by legislation, will not vary according to a State's political strength. MAD PS at 3. In the interest of fairness and predictability, some uniformity in the consultation and concurrence process is obviously desirable. Federal legislation is one means for achieving such uniformity. Another means is the advice and direction of the State Planning Council. However, the process should remain flexible enough to accommodate the specific concerns of particular States and Tribes. One instrument for achieving such flexibility is the negotiation of an agreement between the Department and each potential host State. The Department does believe that the consultation process will tend to lead to agreement on siting questions. To date, an encouraging degree of cooperation has been achieved between the Department and the States of Louisiana, Mississippi, New Mexico, Nevada, Texas, Utah, and Washington.

Some Participants stress that even a strong commitment to share information does not ensure that the Federal Government will address State concerns. CEC PS at 23; NY PS at 24; NRDC PS at 69. Some examples of mechanisms which have been established by the Department in cooperation with affected states where exploration activities are now being conducted can be cited as evidence that the Department is in fact willing and able to address State concerns. The Department is working closely with the Texas Energy and National Resources Advisory Committee, as requested by the Governor of Texas (9-11), in formulating plans for investigation of geologic formations in

Texas. An agency of the State of Texas, the Texas Bureau of Economic Geology, is the principal technical investigator for the U.S. Department of Energy, and the Bureau's recommendations are directly incorporated into the Department's program. Investigative activities in the State of Mississippi were conducted only after completion of a written agreement with the State (12). As indicated in the recent letter from Louisiana (13), Department of Energy funds have been provided to the State of Louisiana to assist in the formulation of plans. Similar agreements with other States exist. The Department fully intends to continue pursuing similar arrangements with other States that might become involved in the program, depending upon the nature of investigation proposed and the expressed desires of each individual State government.

Participants doubt that the process will go smoothly. For example, one Participant concludes that the idea implicit in the policy of consultation and concurrence is that the process will lead to agreement on siting questions. Three Participants doubt that this process, with its emphasis on information sharing, will reduce or eliminate State opposition. NRDC PS at 69; NY PS at 74; CEC PS at 27 and 28. One Participant maintains that the Department assumes that discussions with State and local officials inevitably lead to consensus, but that in the real world it often leads to disagreements. NY PS at 74. When State concerns about substantive and definable issues arise, the Department's policy is to modify its activities as necessary to address such concerns and thus to avert conflicts. While the Department lacks the legal authority to give States a formal veto, it does not believe that the Federal Government will eventually be forced to impose repositories on unwilling States or Tribes. The Department believes that involvement of State, Tribal, and local government in the decisionmaking process through consultation and concurrence will enable the Federal Government to steer a middle course between State veto and Federal supremacy.

Thus, argues one Participant, the Department should evaluate the potential for delay resulting from the currently unsettled nature of State and local involvement. OH PS at 15. The Department recognizes that accommodation of State, Tribal, and local concerns will require time. Accordingly, schedules presented in the Department's Statement of Position allow time for interaction with State, Tribal, and local governments. For example, the schedule outlined in Figure III-3 of the Department's Position Statement

allows 18 months for consultation and concurrence following preparation of the site recommendation report. DOE PS at III-11. It also allows an additional 12 months for extension of NRC review of the construction authorization application in order to accommodate State, Tribal, and local concerns during the Atomic Safety and Licensing Board hearings.

II.A.4.3 Availability and Adequacy of Conflict Resolution Mechanics

As indicated above, several Participants point out that State and local involvement in the decisionmaking process will not inevitably lead to agreement. As one Participant observes, State and local challenges to Federal jurisdiction are growing. CEC PS at 26. A survey shows that Wisconsin residents believe that a waste repository in Wisconsin should be for in-state wastes only. WN PS, Kelly at 20. Participants observe that public opposition to waste repositories runs high--as a result of both parochialism and lack of trust in government's ability to safely manage nuclear waste. This opposition has taken the form of restrictive State and local laws. NRDC PS at 57, 70; MN PS at 5,6; NRDC PS at 6. Participants point out that to the extent State and local involvement does not eliminate such State and local opposition, a mechanism for resolving conflicts is required. Yet, according to these Participants, no such mechanism has been established. NRDC PS at 69; Vi PS at 2 and 3; CEC PS at 27; WN-Kelley PS at 4.

The Department of Energy, the State Planning Council, and the Congress are now identifying and evaluating a variety of mechanisms for resolving conflict in the event a State does not concur on some issue. NRC's licensing proceedings are one mechanism for resolving technical issues bearing on public health and safety. Another mechanism is arbitration by a non-governmental neutral third party. Yet another mechanism involves resolution by the President and/or Congress. Based on the recommendations of the Department of Energy, other Federal agencies, interested non-governmental groups, and the State Planning Council, Congress is soon likely to enact legislation establishing one or more of those conflict resolution mechanisms. (Indeed, the Senate has already done so, as part of S.2189.) The State Planning Council itself may also be helpful in resolving disputes, even though the Council is

not intended to supplant the role of individual State and Tribal governments in negotiations with the Department of Energy.

The Department agrees that detailed conflict resolution mechanisms have not yet been defined and that they will need to be defined before completion of the waste management program. However, mechanisms for working with State and local governments are being established and used during the current phase of the program, which involves collection of geologic, hydrologic, and environmental data by methods having no greater physical effect than similar studies conducted for non-nuclear purposes. The establishment and testing of these cooperative mechanisms in this stage of the program, and the continuing work of the United States Congress, the State Planning Council, the National Governors' Association, the National Association of State Legislatures, and various Federal departments (including the Department of Energy) are all directed toward providing the requisite conflict resolution mechanisms at the time they are needed. Legislation passed by the Congress (e.g., S.2189), resolutions of the State Planning Council (see, e.g., resolution of meeting of 3 June 1980, cited in the letter to Governors by Assistant Secretary for Nuclear Energy George W. Cunningham, Appendix B); and Policy Statements of the National Governors' Association and the National Association of State Legislatures have all addressed the waste management issue and contributed to definition of the required institutional mechanisms (14-16).

The focus of attention of all of these bodies of government officials that has been demonstrated in the past year and the common approaches reflected by each provide confidence that the processes that have served the national government for 204 years will provide a definition of adequate conflict-resolution mechanisms on a timely basis.

II.A.5 Capability of the Department to Manage the Waste Program

Several Participants have questioned the capability of the Department to manage the storage and disposal program. Some Participants in this proceeding have judged the organization inadequate, complex, and fragmented and have questioned whether or not coordination of the several entities involved in this activity can be achieved. CEC PS at 19 and 20; WN PS, Deese at 4. Two Participants contend that the storage and disposal program is

inadequate or lacks coordination and specificity. CEC PS at 19 and 20; WN PS, Deese at 4. The State of Wisconsin believes that the decentralized organizational layers of management contribute to the problem. WN PS, Deese at 4. The California Energy Commission suggests that the only way to implement a sound program is to initiate a major reorganization of DOE's managerial structure. CEC PS at 19.

The Department's management structure and organization to implement the storage and disposal program are described in the Department's Statement of Position. DOE PS at III-2 to III-7; V-17 to V-20. The wide range of program activities needed for successful accomplishment of the program goals necessitates the participation of a multitude of organizations in the program. The Department's management structure provides the flexibility to effectively use the technical and nontechnical talents of the participating organizations. As evidence of this flexibility, between the publication of the Department's Position Statement and the submission of Statements by other Participants, some revisions in the Department's organization have been made. On 20 June 1980, the Assistant Secretary for Nuclear Energy announced a revised organization structure.

In order to provide more centralized direction and coordination to the National Waste Terminal Storage Program, the Deputy Secretary of Energy has approved the establishment of a central program office, to be located in Columbus, Ohio, which will report to the Deputy Assistant Secretary for Nuclear Waste Management through the Office of Waste Isolation. The necessary allocation of resources for this office has been established, and the organizational change will take effect on 1 October 1980, the beginning of the next fiscal year. At that time the organization shown in Figure II-1 will supplant that shown in the Department's Position Statement. DOE PS, Fig. III-1. The responsibility of headquarters organizations is substantially the same as that described in the Position Statement, DOE PS at III-2 and at V-17, except that the Division of Waste Isolation and the Division of Transportation and Fuel Storage have been designated as Offices within the Department.

The Columbus Program Office will have the responsibility to coordinate all efforts currently being carried out by the Basalt Waste Isolation Project (BWIP) at the Hanford Site, the Nevada Nuclear Waste Storage Investigations (NNWSI) at the Nevada Test Site, the Office of Nuclear Waste

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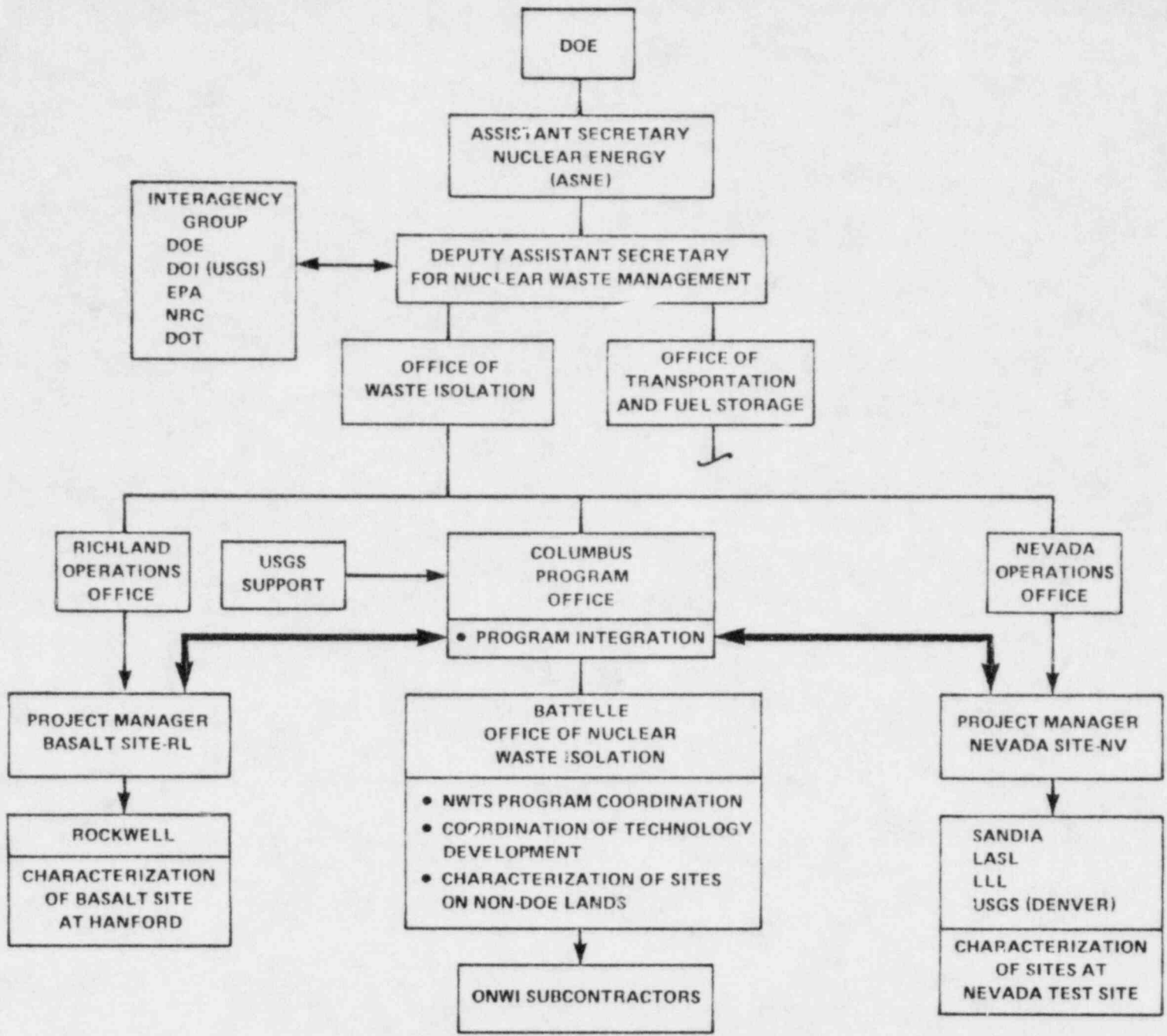


Figure II-1. National Waste Terminal Storage Program Management

Isolation (ONWI) investigations on characterizing sites on non-Department of Energy lands, and all activities related to development of technology. The detailed activities and actions needed for this coordination will be implemented by the Office of Nuclear Waste Isolation of Battelle. In order to provide the necessary technical and analytical support to the Columbus Program Office, and in anticipation of its establishment, on 1 July 1980 Battelle announced a restructuring of ONWI.

Conflicting budgetary incentives, confused channels of communication, and disproportionate funding of R&D programs for disposal are alleged as examples of an overall lack of managerial accountability. CEC PS at 19, 20; WN PS, Deese at 3. Budgetary needs of each of the Department's program elements will be analyzed, determined, and recommended for Headquarter's approval by the Columbus Program Office. The responsibility of management of resources to accomplish the given objectives within the budgetary allocations remains with the field operations offices, thus utilizing the advantages of decentralized program activities.

Additional program integration is achieved by an Isolation Interface Control Board, which has been established to provide recommendations to the Department for coordination and control between the various waste isolation programs (i.e., ONWI, BWIP, NNWSI, the Subseabed Program, and Waste Isolation Pilot Plant (WIPP) Program). The Interface Control Board is chaired by the General Manager of ONWI and includes representatives from each of the waste isolation program elements. Furthermore, several Interface Coordination Groups have been formed to consider individually such waste isolation system and program elements as waste package, repository, site qualification, licensing, field tests and facilities, and system activities. The Interface Coordination Groups report to the Interface Control Board, which in turn recommends for Headquarters approval (through the Columbus Program Office) any program redirection needed and the budgetary allocations required to better implement various activities in the program.

The concern raised by the California Energy Commission regarding ". . . conflicting professional and budgetary incentives, confused channels of communication, and an overall lack of managerial accountability," CEC PS at 19, will be greatly mitigated under the new coordinated managerial structure.

The same Participant states that the organizational structure carries the danger that those in charge of work on a particular geologic medium will likely set out to prove, rather than investigate the suitability of that medium. CEC PS at 19. The site selection process is described in the Department's Position Statement. DOE PS III-8 to III-24. The decisionmaking process will be further delineated in the forthcoming National Site Characterization and Selection Plan. DOE PS at III-39. Control and allocation of program resources and decisions on site suitability are retained within the control of Department of Energy officials. Actual allocation of funds between program elements is made by the Deputy Assistant Secretary for Nuclear Waste Management after reviewing recommendations of the Columbus Program Office and the Office of Waste Isolation. Decisions on suitability of a site and any decision to proceed with an application for a license for either an away-from-reactor storage facility or a geologic repository will be made by officials in the Department at the level of the Assistant Secretary and higher. In the Department's Position Statement, the relationship of the Department of Energy to other Federal departments was described. DOE PS at III-42 to III-48. The overlapping responsibilities of the various agencies and the strong involvement of the Executive Office of the President make it clear that the choice of a site for a repository will not be the Department's alone; this relationship will tend to neutralize any parochialism within the Department.

Decisions by Department officials are, of course, based upon recommendations made by the program organization and its contractors. However, as described in the Department's Position Statement, extensive use is being made of technical review and advisory groups to ensure the adequacy of the Department's programs and its recommendations. DOE PS at III-26. A strong interactive process, characterized by intensive scientific peer review, serves to ensure that recommendations on repository siting will be soundly based.

The State of Wisconsin challenges the effectiveness of the Department's internal program organization. WN PS, Deese at 4. Although a relatively small number of engineers and physical scientists in the Department's Headquarters are involved in the management of the program, the personnel at the Columbus Program Office and approximately 200 employees at the Office of Nuclear Waste Isolation in Columbus complement and augment the

activities performed by Headquarters personnel. Through the ONWI organization, social scientists provide appropriate input to the program.

Several Participants take the position that the historical record of the Federal Government's performance in management of nuclear waste creates lack of credibility in the Department's ability to implement the program described in the Department's Position Statement. Several Participants, for example, claim that there is lack of credibility or trust in the ability of the Department, the NRC, and the nuclear industry to manage the program based on past performance. NRDC PS at 3, 6, 68; SE2-CN PS at 5, 20; NECNP PS at 32; CEC PS at 29, 30, 40. SHL PS at 3; ECNP PS at 1. The California Energy Commission states that one of the largest impediments to successful implementation of a waste disposal program is a deep-seated suspicion of the institutions which manage nuclear energy. CEC PS at 29. Some Participants feel that public skepticism stems from the government's history of failure to produce an acceptable method of waste disposal. CEC PS at 30; MN PS at 20; NY PS at 9; Lewis PS at 3. The Department maintains that lessons have been learned from past experience. As demonstrated in the Department's Position Statement, these lessons are being reflected in the NWTS Program and mechanisms exist to incorporate other changes that may be necessary to maintain and enhance the Department's management ability. DOE PS at III-2 to III-7. As described above, the Department is able to adjust its management structure to meet new needs.

Another Participant cites the fact that 35 years have passed without significant progress toward the establishment of a permanent facility. OC PS at 8. Other Participants state that the projected date for repository availability has again and again been postponed. NY PS at 35; AIChE PS at 5. The State of California claims that when there is a history of accomplishment, then there may be grounds for belief that a repository will be operating by the year 2006. CEC PS at 46. The Department does not agree with those Participants who claim that the historical record represents a lack of progress. For example, technical success was achieved with the R&D project at Lyons, Kansas. A large amount of data was obtained and is being used today. The results from this project are delineated in the Department's Position Statement. DOE PS at II-252 to II-253. In addition, in situ tests at Avery

Island in Louisiana, spent-fuel tests at the Colorado School of Mines, investigations on argillite at the Nevada Test Site, and Conasauga near-surface heater experiments in Tennessee have provided a great amount of useful information and knowledge. DOE PS at II-256 to II-258; II-261 to II-266. The experiments and field tests being conducted at the Asse mine in the Federal Republic of Germany and at Stripa and Studsvik in Sweden have also provided valuable information to US programs through cooperative international agreements. DOE PS at II-253 to II-255, II-258 to II-261.

Furthermore, a significant amount of scientific information has been developed for disposal of waste, as described in the Department's Position Statement. This includes, for example, development of models to predict and assess the performance of mined geologic disposal systems. DOE PS II-198 to II-242. Experimental work now in progress has provided a wealth of scientific data. DOE PS at II-242 to II-270. Widely diverse regions where actual field explorations have taken place are providing data to be used in site selection. DOE PS at II-103 to II-126. In the area of investigation of waste forms and development of waste package systems, a considerable amount of information has been gathered. DOE PS at II-137 to II-160. Significant advances in the field are being made, as demonstrated by the numerous scientific and technical papers referenced in the Department's Statement of Position. DOE PS at II-306 to II-368.

NRDC claims that Federal officials have failed to understand that the problems are not solely or even primarily technical in nature, but that technologists have seriously underestimated the difficulty of keeping wastes out of the biosphere. NRDC PS at 20. These two claims are somewhat inconsistent in that NRDC first claims that the Department has realized that its problems are primarily nontechnical and then that it has underestimated the technical difficulties associated with disposal. The import of both technical and nontechnical issues has been recognized, and a comprehensive program is set forth in the Department's Position Statement. DOE PS at III-1 to III-51.

Another concern is that the government has had a series of major changes in direction and focus from geologic disposal to retrievable surface storage and back. NRDC PS at 3, 71. ANS charges that this apparent lack of direction has created unnecessary public apprehension. ANS PS at 5.

It appears that, during the early 1970's, the program had inadequate funding for conducting the required development program. This resulted in a lack of specific direction to implement the permanent disposal option. Since 1977, funding has been significantly increased, interagency cooperation has taken place as evidenced by the IRG effort, a Presidential policy has been established, and Congress has initiated significant activities in this area. These changes will ensure that a repetition of the earlier experience will not occur.

Other Participants claim there has been a historic lack of interest in the problem of radioactive waste. MN PS at 19; NECNP PS at 1. The Department does not intend to argue the merits of these statements. The facts today are that there is a strong degree of interest in the problem of radioactive waste, as described above.

Another Participant claims that the rejection of the Palestine Dome in Texas is an example of the Department's inability to manage; i.e., the program cannot identify acceptable sites. NECNP PS at 30 to 31. On the contrary, this is an example not of error, but rather of the Department's ability to conduct tests and investigations, to observe scientific facts, and to make decisions based on these considerations.

Contrary to the above positions, one Participant points out that the government, based on its activities during the past 2 years, does appear to be facing up to its responsibility. It says the machinery is finally being set in motion to resolve the political problem associated with nuclear waste disposal. SE2-CN PS at 21. The Department agrees with this position and submits that the NWTS Program has been significantly modified as a result of thorough extensive interagency and public review and comment. A formal, structured program provides a positive means for measuring progress, irrespective of the incumbent managers, and includes a mechanism for involving both state and local officials, as well as the public. Such an integrated approach provides a firm basis to define both technical and institutional milestones, as discussed in the Department's Position Statement.

In conclusion, the Department's management structure provides the necessary guidance for the various expert organizations and individuals to successfully complete the waste isolation program and make a safe and environmentally acceptable repository available in the time frame of 1997-2006. The management structure is flexible enough to accommodate any changes that may be

required in the future, as the recent reorganization illustrates. Also, the Department believes that past program history has provided valuable experience in both technical and nontechnical areas.

II.A.6 Continuing Availability of Funds and Resources

A few Participants question whether Congress will continue to adequately fund the Department's waste management program. They suggest that other projects may be given a higher priority or that institutional pressure to dispose of the wastes may be lessened in the future. As a result, they conclude, the funds and resources necessary to fully implement the program may not be available, and hence one cannot have confidence in the Department's schedule. One Participant questions the continued national commitment to the program by postulations that funds may be channeled to projects more attractive to Congress and the public. Lewis PS at 9. Another Participant concludes that there is no assurance that Congress will continue funding an expensive long-term program. CDC PS at 7. Of course, the Department cannot guarantee that money will be available; neither can other Participants state with certainty that it will not be available. The Department will support an adequate level of spending for the NWTS Program and continue to request sufficient funding to carry out the program described in the Department's Statement.

Congress' commitment to the commercial waste management program is demonstrated by continuous increases in the level of funding since 1976. For FY 1976, the funding level for commercial waste management was at \$14 million; for FY 1980, the funding level for commercial waste management is at \$219 million; this increase demonstrates a significant commitment to the Department's program. The trend is clear: Congress is committed to appropriate sufficient funding to resolve the nuclear waste disposal problem.

The State of Ohio expresses concern that the Department's AFR storage program will remove pressure to resolve policy questions concerning a permanent waste disposal strategy, thereby drawing attention and resources away from a permanent solution. OH PS at 19. The Department simply does not agree with the Participant's implication that "pressure" resulting from a lack of AFR capabilities is necessary or desirable to resolve policy questions

concerning a permanent waste disposal strategy. It should be clear that a strong national commitment for disposal exists now, and the Department finds no reason to believe it will not persist until safe, environmentally acceptable facilities are available. AFR's will only provide safe interim storage and allow time to thoroughly investigate sites and further develop technology disposal. In his message of 12 February 1980 the President stated, "I want to stress that interim spent-fuel storage capacity is not an alternative to permanent disposal." DOE PS, App. A.

II.A.7 Impact of Regulatory Uncertainties on the Program

Several Participants express concerns about the role of regulatory bodies in the waste management program. The Participants comment on the following general topics: (i) the lack of definitive regulatory criteria, (ii) the lack of demonstrated conformance with preliminary criteria, and (iii) so-called "gaps" in regulatory authority. A philosophy apparently underlying several of these comments is that safety is achieved by regulation alone, and that, if there are no regulations, one cannot be assured of the safety of a proposed operation. The general areas of interest as they affect either disposal or storage are discussed below.

II.A.7.1 Lack of Final Regulatory Criteria

With respect to disposal, several Participants criticize the Department's waste program because of certain regulatory uncertainties resulting from the fact that the Commission has not established final regulatory criteria against which disposal sites can be evaluated. NECNP PS at 119; NRDC PS at 17, 39. It is pointed out that neither EPA nor NRC has set forth the standards by which a facility will be sited, constructed, and operated. IL PS at 2; CDC PS at 6; MN PS at 5. The California Energy Commission also cites a need to have specific performance criteria established and agreed to by all interested parties. CEC PS at 25.

The Department acknowledges in its Statement of Position that definitive criteria from NRC and EPA would be a substantial aid in focusing its disposal program, but maintains that the lack of such criteria is not a

serious impediment to progress at the present time. DOE PS at II-4. The Department's program is sufficiently flexible that the projected schedule will not be greatly altered as a result of codification of regulatory requirements of the EPA and the NRC. DOE PS at III-31 to III-36.

NRDC asserts that the Department has developed " . . . a set of siting criteria which are so general and vague that virtually any area could be found satisfactory for further investigation . . . ," and further implies that detailed siting criteria should be developed prior to undertaking site-specific studies. NRDC PS at 28-31. The Department submits first that definite criteria are not necessary at this time. A sound basis for guiding siting activities until such time as final criteria are adopted by the Commission has already been presented. DOE PS at II-80 to II-83, III-8 to III-31. As indicated therein, DOE PS at II-81, "More quantitative criteria will be developed for each study location to guide site-specific decisions on suitability." Second, the Department submits that attempting to establish definitive siting criteria at this early stage would be premature. The importance of certain site features is best determined on a site-specific basis because the desirability or undesirability of a given site feature depends on how the feature affects the system performance. It is the overall performance of a site-specific system that is important, not the generically presumed attributes of particular features. Prematurely established criteria could eliminate potentially superior sites on the basis of perceived flaws that may in actuality be unimportant to the effectiveness of a site-specific disposal system.

NRDC further contends that the disposal criteria will be developed to fit a specific site in order to guarantee that the criteria will be met. NRDC PS at 30, 31. This overlooks the fact that such criteria will not be developed without independent review. Extensive scientific and technical reviews of site criteria are being undertaken by different means. The Department seeks review by outside independent experts and by interested State agencies. Furthermore, the Department has supplied funds directly to States to permit the States to hire scientific experts. (See, e.g., in Appendix B of this Cross-Statement, the letter dated 30 July 1980 to George W. Cunningham from Frank A. Ashby Jr., Secretary, Louisiana Department of Natural Resources.) The determination of the suitability of any particular site for placement of a

repository depends upon an evaluation of the overall system performance at that site rather than the isolated consideration of individual factors.

Another Participant concludes that the Department violates its own proposed disposal Objective 6, DOE PS at II-18, because all the criteria and methods necessary to evaluate many aspects of the waste disposal issue are not in place. NECNP PS at 26, 27. The Department recognizes that a mechanism is required for judging the acceptability of its program, and therefore proposed in its Position Statement seven overall objectives by which to judge the Department's disposal system. DOE PS at II-7 to II-21. The Department submits that those seven objectives are sufficiently comprehensive and detailed that the NRC can (i) use them as a means of assessing the NWTS Program for the purposes of this proceeding and (ii) reach a finding of confidence that wastes will be disposed of in a safe and environmentally acceptable manner if those objectives are met.

One Participant claims that the Department's Position Statement contains conflicting discussions regarding regulatory requirements for waste disposal facilities. NECNP PS at 52, 53. In response, the Department notes that the cited discussions relate to the proposed NRC regulations (10 CFR Part 72) for independent spent fuel storage installations. Furthermore, the cited paragraphs, DOE PS at IV-4 and IV-23, are not in conflict, as the former refers only to accident guidelines which are intended to permit location of independent storage facilities at reactor sites without significantly increasing the potential for off-site consequences in an accident situation, while the latter refers to the general safety standards for AFR's.

With regard to spent-fuel storage facilities, NECNP implies that, because 10 CFR Part 72 is not yet a final regulation, it cannot be relied upon to support the Department's position that fuel can be stored safely; NECNP goes on to state that 10 CFR Part 72 will not apply to reactor storage pools at which a majority of the spent fuel will be located, and that such pools ". . . will not likely comply with the requirements specified." NECNP PS at 59,60. In light of these suggestions, the following additional clarification related to the interim storage aspects is provided: On 6 October 1978, the NRC published in the Federal Register, 43 Fed. Reg. 43309, proposed 10 CFR Part 72 entitled, "Storage of Spent Fuel in an Independent Spent Fuel Storage Installation--Proposed Licensing Requirements." The

relationship of the proposed regulations to existing reactor facility requirements and the applicability of these new regulations were clearly delineated. The Department discussed these aspects in its initial Position Statement. DOE PS at IV-23 to IV-25. This set of proposed regulations applies no new safety criteria for interim storage of spent fuel, but it does restate those requirements of existing regulations that apply to power reactors, reprocessing plants, and other fuel cycle facilities, and are pertinent to an away-from-reactor storage facility. These were modified as appropriate to recognize the less severe conditions created by the storage of aged spent fuel. On this basis, the Department asserts that, although 10 CFR Part 72 is only at the "proposed" stage, it is indicative of NRC staff positions on spent-fuel storage facility requirements and is appropriate for use in its Statement. All that is missing at this time is final NRC action on the regulation. Recognizing the purpose and intent of the proposed 10 CFR Part 72, as represented by the NRC when it published the draft for comment, the Department submits that there are no inconsistencies or defects in the Department's approach for obtaining a license for an away-from-reactor storage facility.

Two Participants suggest that the Department fails to adequately account for the possibility of future changes in storage licensing requirements and their impact on away-from-reactor storage facilities. NECNP PS at 57, 73-74; IL PS at 1, 2. The Department submits there is considerable prior experience with safe storage of spent fuel; also, there are no demonstrated deficiencies in current design, construction, or operational practices for spent-fuel facilities or probable sources of problems. The Department's programs have adequate flexibility to meet additional regulatory requirements as they occur. The Department asserts that it is unlikely that any future regulatory changes would materially impact the conclusions that have been presented in its Statement.

Safe Haven, Ltd., asserts that a generic decision cannot be made regarding the continuing safety of storage of spent fuel at existing plants because of the individuality of the plants. SHL PS at 5. The Department submits that the Safe Haven, Ltd., assertion is based on a misunderstanding of the respective roles of "generic findings" (e.g., rulemakings) and case-by-case licensing findings. It is true that each fuel storage pool for which NRC authority for capacity expansion is sought is individually and carefully

examined by the Commission with respect to its ability to store additional fuel and the safety of continued storage. Indeed, the Commission has noted:

Because there are many variations in storage pool designs and limitations caused by spent fuel already in some pools, the licensing reviews must be done on a case-by-case basis. Modifications in the Technical Specifications applicable to the reactor plant involved, covering safety considerations both during the construction phase of the proposed modifications and subsequent operations, are made where necessary. DOE PS, Ref. IV-1, Vol. 1 at 5-2.

However, the differences among the spent-fuel pools, though conferring a certain measure of uniqueness to each pool, do not materially impact the long-term safety question. The at-reactor storage facilities must be designed to receive spent fuel directly from the reactor, and are designed and constructed to more conservative criteria than are required for away-from-reactor storage facilities for aged fuel. The Commission already has observed in connection with the long-term safety implications of increasing the storage capability of a reactor storage pool:

It should be kept in mind that increased at-reactor spent fuel storage involves only aged fuel (at least one year since discharge) which has orders of magnitude less hazard potential than fuel freshly discharged from a reactor. DOE PS, Ref. IV-1, Vol. 1 at ES-5.

The Commission has also said:

Increased storage of spent fuel at any facility simply results in the retention of older fuel that would otherwise have gone to reprocessing or disposal. Volatile and non-volatile radionuclides with short half-lives will have decayed to negligible levels. Consequently, the radiological and heat load impacts of this older fuel are factors of ten lower than that of the less cooled fuel and result in a small incremental impact to health and safety. Thus, environmental and health impacts of spent fuel storage are dominated by new spent fuel, and whether older fuel is present or is disposed of has little impact on the health and safety posture as a whole. DOE PS, Ref IV-1, Vol. 1 at 4-9.

In conclusion, the Department submits that safety is introduced by facility design through exercise of conservative engineering based on demonstrated principles, and is attained by assuring high-quality facility construction and responsible operation. DOE PS at II-22 to II-26, IV-20 to IV-40. NRC regulations exist and are in force for at-reactor fuel storage. The currently proposed 10 CFR Part 72 regulations, which are indicative of NRC Staff positions on storage, have been modified as appropriate to recognize the less severe conditions created by the storage of aged spent fuel at away-from-reactor storage facilities and can readily be met. Finally, although NRC and EPA regulations concerning disposal facilities are still under development, the objectives proposed by the Department in its Position Statement can be appropriately used in this rulemaking prior to formal promulgation of final EPA and NRC regulations. The Department therefore submits that an adequate basis exists for a determination that the Department's waste management system will meet regulatory requirements.

II.A.7.2 Conformance With NRC Draft Criteria

In the absence of final NRC disposal regulations, it has been suggested by a few Participants that the Department's program should be assessed on the basis of certain NRC draft criteria. NRDC claims that the NRC draft technical criteria for repository performance conflict with those of the Department and cannot be met by the Department's program. NRDC PS at 4, 17. The California Energy Commission also expresses concern that NRC issued its draft regulations prior to establishment of EPA's standards, which are to be implemented by NRC. CEC PS at 25. Similarly, the State of Minnesota focuses attention on the use of the NRC draft material concluding that conformance has not been demonstrated and that the Department should expend additional effort in this area. MN PS at 4, 5; MN PS, Abrahamson at 4-11. NRDC contends that no potential site has been evaluated against the draft NRC criteria; NRDC implies that the Department should, at a minimum, assert that NRC requirements have been satisfied. NRDC PS at 30. Subsequently, NRDC asserts that the Department has not presented evidence to demonstrate how these NRC criteria can or will be met. Using such arguments, NRDC claims that the Department has not developed a plan that will meet NRC criteria. NRDC PS at 27-35.

The above assertions indicate confusion on the part of several Participants regarding the "advance notice" procedure used by the Commission in developing technical criteria for waste disposal. This conclusion is exemplified by the Position Statements of NRDC and the State of Minnesota. NRDC PS at 27-35; MN PS at 4, 5; MN PS, Abrahamson at 4-11. The NRC issued an Advance Notice of Proposed Rulemaking (ANPR) on 13 May 1980, 45 Fed. Reg. 31393, relating to 10 CFR Part 60, Technical Criteria for Regulatory Geologic Disposal High-Level Radioactive Waste. This ANPR is being misconstrued as a regulation that sets absolute requirements when, in fact, the ANPR is not even the equivalent of a proposed rule.* This ANPR specifically has been characterized by the NRC Staff to the Commissioners as not even ready for use as a proposed rule (17). As indicated by the NRC Staff in October 1979, the provisions of the ANPR are strawman** criteria, derived for the purpose of focusing attention on major issues (18). This point was reiterated by the NRC in its Federal Register notice, 45 Fed. Reg. at 31394, which said, "These criteria do not necessarily represent staff positions with respect to rulemaking on this subject." Their issuance is aimed at seeking comment on major technical issues before the proposed technical rule is developed. The Department has been aware of the development of these strawman criteria and on 15 July 1980 provided comments to NRC on the ANPR. Others were also invited to do so by the Commission's Federal Register Notice. The Department does not consider it appropriate to demonstrate or assert conformance with such draft material in this proceeding. The Department interprets the NRC Staff position as anticipating many changes in these preliminary criteria before they will be suitable for use in a detailed review of the Department's program. At the

*The Commission recently discussed the difference between an advance notice of proposed rulemaking in denying a petition for rulemaking that requested, inter alia, that an advance notice of proposed rulemaking precede all proposed regulations. 45 Fed. Reg. 53834 (Aug. 13, 1980). The Commission noted that an advance notice is a useful tool to be employed at the Commission's discretion to gauge public interest or obtain public assistance on certain issues in early stages of development. This recent decision reinforces the conclusion that the advance notice on disposal criteria is simply a vehicle to obtain early comments to assist in development of proposed rules.

**The term "Strawman" has been used by the NRC Staff to characterize the draft criteria.

time it applies for a license to construct or operate a repository, the Department will make appropriate showings of compliance with applicable regulations.

In its Position Statement, the Department states its underlying premise: that it has a responsibility for assuring public health and safety and protection of the environment relative to nuclear waste disposal systems. Notwithstanding any independent oversight that will be provided by the NRC, the Department is independently responsible for safe and environmentally acceptable repositories; it must establish goals, objectives, and performance standards consistent with this responsibility. Since the Department will also be an applicant and an NRC licensee, it is actively following the development of both EPA and NRC standards and regulations. For example, it submits comments for the consideration of NRC and EPA which are part of the public record of the rulemaking proceedings of those agencies. Coordination is necessary in order to share technical developments/information/data, and early interaction is necessary for awareness of potential variances in safety approaches.

To suggest that 10 CFR Part 60 be used as a basis of measurement in this rulemaking is to suggest that the rulemaking be delayed until such time as the NRC promulgates that regulation in final form. The Department opposes such a delay. It is the Department's understanding that, before these criteria can be thus promulgated, NRC will issue an environmental impact statement concerning the proposed criteria, will receive public comment on both the EIS and the criteria themselves, and will issue the rules under procedures required under the Administrative Procedures Act and the Commission's regulations.

In conclusion, the Department acknowledges that NRC and EPA standards and criteria for waste disposal are still being developed. However, the Department points out that the proposed NRC procedural requirements are intentionally structured to allow a step-by-step regulatory involvement in site selection, construction, operation, and decommissioning. As technical criteria are proposed to complement these steps, the Department will have the opportunity to reassess its program relative to its conformance to the requirements. Early involvement of NRC in reviewing Site Characterization Reports (Plans) submitted by the Department also should eliminate a majority of uncertainties that may exist. See DOE PS at III-13. Consequently, the

Department submits that it would be inappropriate to utilize draft NRC or EPA criteria in this rulemaking.

II.A.7.3 Continuity of Regulatory Supervision

One Participant suggests that spent fuel may be left unmanaged if a utility gives up on a facility either as a business decision or as a result of bankruptcy. NRDC PS at 90-91. Another Participant asked for clarification of the responsibility for the storage of high level wastes in the event of mergers, bankruptcy, or expiration of a facility's license. DE PS at 4.

That the Commission has adequately anticipated this contingency is apparent from the nature of regulations contained in 10 CFR Part 50 and proposed 10 CFR Part 72. These regulations clearly establish that the Commission retains jurisdiction over the spent fuel involved in a merger or bankruptcy in a fashion that guarantees that the proper management of spent fuel is assured, as described by the following provisions of 10 CFR Part 50; DOE PS, Ref. IV-38:

50.80 Transfer of licenses.

- (a) No license for a production or utilization facility, or any right thereunder, shall be transferred, assigned, or in any manner disposed of, either voluntarily or involuntarily, directly or indirectly, through transfer of control of the license to any person, unless the Commission shall give its consent in writing.

50.81 Creditor regulations.

- (a) Pursuant to section 184 of the Act, the Commission consents, without individual application, to the creation of any mortgage, pledge, or other lien upon any production or utilization facility not owned by the United States which is the subject of a license or upon any leasehold or other interest in such facility: Provided:
 - (1) That the rights of any creditor so secured may be exercised only in compliance with and subject to the same requirements and restrictions as would apply to the licensee pursuant to the provisions of the license, the Atomic Energy Act of 1954, as amended,

and regulations issued by the Commission pursuant to said Act; and

- (2) That no creditor so secured may take possession of the facility pursuant to the provisions of this section prior to either the issuance of a license from the Commission authorizing such possession or the transfer of the license.
- (b) Any creditor so secured may apply for transfer of the license covering such facility by filing an application for transfer of the license pursuant to 50.80(b). The Commission will act upon such application pursuant to 50.80(c).
 - (c) Nothing contained in this regulation shall be deemed to affect the means of acquiring, or the priority of, any tax lien or other lien provided by law.
 - (d) As used in this section:
 - (1) "License" includes any license or construction permit which may be issued by the Commission with regard to the facility;
 - (2) "Creditor" includes, without implied limitation, the trustee under any mortgage, pledge or lien on a facility made to secure any creditor, any trustee or receiver of the facility appointed by a court of competent jurisdiction in any action brought for the benefit of any creditor secured by such mortgage, pledge or lien, any purchaser of such facility at the sale thereof upon foreclosure of such mortgage, pledge, or lien or upon exercise of any power of sale contained therein, or any assignee of any such purchaser.

Proposed 10 CFR Part 72; DOE PS, Ref. IV-4; contains generally similar provisions in Sections 72.36 and 72.37. Furthermore, the Atomic Energy Act of 1954, as amended, provides criminal penalties for willful violation of provisions of the Act, or of any regulation or order issued under Section 161(b), which authorizes the establishment of rules, regulations, or orders governing the possession and use of special nuclear material, source material, and byproduct material (19).

NRDC also asserts that the abandonment of the nuclear fuel "dump" at West Valley, New York, demonstrated that there is little assurance that a regulatory authority can guarantee proper management of spent fuel. NRDC PS at 91. The NFS West Valley plant was licensed by the AEC in 1966 to reprocess spent fuel for recovery of uranium and plutonium, and to concentrate the fission products which were separated therefrom, and such license remains in effect. DOE PS, Ref. IV-48. A spent-fuel storage capability was provided in the plant as built to accommodate a surge supply of spent fuel for reprocessing operations. The plant operated until 1972 when it was shut down for modification and expansion. In 1976, NFS determined that it was not economical to complete the modification and expansion program and announced its intent to close the plant (20). After shutdown of the plant in 1972, NFS continued to receive and store spent fuel; at the present time about 163 MTU is in storage there. DOE PS at IV-27. NFS currently maintains a staff of about 50 persons plus a contract guard force at the plant (21). The AEC license for the plant was issued jointly to NFS and the State of New York. This license provided for continuity in protection of the health and safety of the general public (22). In view of the foregoing, the Department sees no basis to conclude that the West Valley plant was in any sense a nuclear fuel "dump," nor that it has been "abandoned" in any sense of the word, nor that there is any likelihood that the spent fuel would be left unmanaged either at West Valley or at a site owned by a bankrupt utility company.

The continuity of regulatory supervision is assured by 10 CFR Part 50 and the proposed 10 CFR Part 72, which establishes that the Commission retains jurisdiction over spent fuel involved in a merger or bankruptcy. The NRC regulations thus provide that the proper management of spent fuel will continue.

II.A.8 Ability to Resolve Public Concerns

Several Participants criticize the Department's Statement of Position for not giving greater consideration to the possibility that public perception of the risk associated with waste management could result in a lack of public acceptance, which in turn could complicate, if not prevent, repository siting. Safe Haven, Ltd., attributes this lack of public acceptance

largely to fear and anxiety over the possibility of radioactive contamination resulting from repository failure. SHL PS at 2.3. The State of Wisconsin indicates that most of the people they surveyed are concerned about the possible human health effects that may result from a repository. WN PS, Kelly at 12. The State of New York also contends that the public perception of risk is high and notes that the willingness to assume the risk is low. NY PS at 72, 74. Another Participant believes that the public perceives radioactive waste disposal as the most hazardous portion of the nuclear fuel cycle and incapable of solution. NFE PS, Dornsife at IV.2-1. Participant Lewis suggests that an extensive repository accident could ". . . kill every man, woman, and child on this earth." Lewis PS at 7.

Public concerns exist despite the consensus among technical experts that even under "worst-case" assumptions repository risks are exceedingly small. Notwithstanding this fact, concerns about public perception of risks associated with nuclear waste may be somewhat overstated. For example, in a recent public opinion survey, 62% of the general respondents sampled agreed with the statement, "The disposal of nuclear waste is a problem that can be solved in an acceptable way." Twenty-six percent disagreed, and 12% were not sure (23). In addition, there is some evidence that even though the level of concern about risk among the public living near a potentially hazardous facility may at first rise, it will then fall as residents become more familiar with the operation of the facility (24).

One Participant notes the existence of extensive public opposition to siting of many AFR storage facilities and concludes, ". . . it cannot be assumed that any AFR site--let alone many sites--will be approved." Ni PS at 109. The Department has found that the requirement for AFR storage facilities is not "many," as this Participant asserts; rather, it ranges from 4 such facilities, if the availability of the first repository is in 1997, to 14, if it is in 2006, assuming 5,000 MTU per AFR. DOE PS at VI-3.

The Department recognizes that public acceptance of nuclear waste storage and disposal will not be achieved instantly. Most new technologies posing some potential risk are at first resisted. The automobile, the airplane, and even alternating-current electricity are cases in point. However, acceptance grows as the benefits become clearly recognizable and the public gains confidence in mechanisms for controlling the technology (25).

The Department submits that the new technology of nuclear waste disposal can follow the same path. Accordingly, the Department attaches particular importance to emphasizing operational safety, demonstrable public health protection, and controllability as means of gaining public acceptance.

The Department submits that through clear communication of technically estimated risks to community leaders and interested citizens, the imbalance between the public's perception of risk and that of scientists will be reduced. In this connection, the Department suggests that the perceived openness of the decisionmaking process for involving community leaders may be at least as important as accurate communication of evaluations of risks themselves. The elements of this decisionmaking process are discussed in Section II.A.4 of this Cross-Statement.

An open program of public education and communication during all phases of waste management is one mechanism the Department will utilize to lessen the current imbalance of risk perception. The consultation and concurrence program is a means of incrementally informing and educating elected officials and the citizenry in geographic areas being investigated. Greater opportunities now exist for visits by the public to Department operations involving radioactive waste. For example, in the past 2 years, 57 tours including 1,572 people were conducted at the Climax Test Facility. Similarly, in the past 16 months, 197 tours were conducted for 1,300 people at the Near Surface Test Facility in Hanford.

Public understanding will also result from the presentation of the results of careful and objective examination of the radioactive waste management issue by credible public institutions. The recent publication of a booklet entitled A Nuclear Waste Primer by the League of Women Voters is an example of public education effort that will lead to greater public understanding (26).

As noted in the opening paragraph, several Participants believe that risk perception on the part of the public could result in opposition and time delays, which are not adequately accounted for in the Department's schedules. NY PS at 4, 56, 57, 73; OC PS at 7; MN PS at 6; NECNP PS at 32; NRDC PS at 6. The Department agrees that the schedule should take into account the potential for such delays and in fact has done so. See the discussion on contingency time presented in this Cross-Statement at II.A.10. The program is

currently operating and making progress in an environment of heightened public concern generated largely because of the previously described public perception of risks. The actual time required to gain public acceptance is admittedly hard to predict; however, the period of 17 to 26 years to repository availability is an ample period to allow for greater public understanding of the technical assessment of risk.

In summary, the public may perceive the risks associated with nuclear waste repositories as greater than the minimal risks indicated by a consensus of technical estimates. However, past experience with other new technologies perceived to be risky by the public indicates that public acceptance is gained as benefits become clearly recognizable and mechanisms for controlling the technology are seen to be effective. Accordingly, the Department believes that its emphasis on safety, clear communication, and involvement of community leaders at all phases of repository development will resolve public concerns.

II.A.9 Cooperation of Industry to Implement Program

Several Participants express the view that spent fuel is a significant energy resource, not "waste." UNWGMG-EEI PS, Doc. 2 at I-1; AICHE PS at 7; AIF PS at 2; and ANS PS at 1. Participants ANS and UNWGMG-EEI believe that the present policy of deferring reprocessing will be eventually changed and spent fuel will be reprocessed. UNWGMG-EEI PS at I-1; ANS at 1. Two Participants express concern that industry will not accept terminal disposal of spent fuel and that this somehow will delay the Department's Program. MN PS at 7; NECNP PS at 120. Due to the lack of acceptance of spent fuel as waste by industry, one Participant expresses the further concern that the necessary transportation system will not be available when needed. NECNP PS at 121.

While certain industry groups may hold the opinion that spent fuel is not "waste," none has indicated a reluctance to cooperate. None of the Participants cites any evidence of lack of cooperation. A clear example of industry cooperation in the program is represented by the continuing participation of Westinghouse in the program for the characterization and encapsulation of spent fuel used in the Climax Spent Fuel Test in Nevada. Through the active participation of both Westinghouse and Florida Power and Light Co.,

title to spent-fuel elements for the climax test was acquired by the Department. Furthermore, an examination of the filings by industry representatives demonstrates that they have given extensive consideration to disposal of spent fuel. The Department believes that industry will continue to cooperate in the effort disposal.

The Department's discussion on the subject of availability of a transportation system is found in the Department's Statement of Position. DOE PS at VI-7 to VI-11. See also Chapter IV.D., infra. The NECNP does not offer any support for its claim that industry's position on reprocessing will preclude the development of a transport system.

II.A.10 Impacts of Certain Factors on Schedules

Several Participants question whether, in light of certain program factors, the Department's schedules for implementing the disposal and storage programs can be met. First, they question whether the first repository will be available within the time frame of 1997-2006 presented in the Department's Statement of Position. The factors that might affect schedules discussed by these Participants can be grouped into three categories: (i) one group supports opinions that the Department's schedules can be shortened and the availability date moved forward; (ii) another group alleges that the Department has allotted insufficient time to reach certain milestones in its schedule; and (iii) the third group would tend to support contentions that one cannot have confidence in schedules that are so long.

Five Participants believe the Department can and should shorten its schedule for the availability of the first repository. AICHE PS at 4 and 5; AIF PS at 26-31; Bech PS at 6; ANS PS at 3; UNWGM-EEI PS, Doc. 1 at 4, 18, and 23. The Department's Statement of Position presents a reference and an extended schedule. DOE PS, Figs. III-2 and III-3. The reference schedule; DOE PS, Fig. III-2; which establishes the earliest date of repository availability as 1997, delineates the logic and the durations of activities that are deemed achievable under current program assumptions. The Department submits that the logic in the schedule network is a sound one and that the durations assigned to each activity are reasonable. Therefore, any shortening of the schedule would not be prudent for planning purposes.

Two Participants contending that the schedule can be shortened state that the 4 years allowed in the schedule for NRC's construction authorization review is too long. AICHE PS at 4 and 5; AIF PS at 26-31. As indicated in the Department's Statement, the 48-month allowance for construction authorization review by NRC is based on the Commission Staff views regarding the length of review time required as expressed at a meeting on 4 October 1979. DOE PS at III-35. The Department agrees that the early familiarity with the project that the Commission Staff will gain in reviewing the Detailed Site Characterization Plan, submitted to the Commission by the Department, and a working familiarity with the R&D projects may permit completion of review in a shorter interval. DOE PS at III-35. The Department would be pleased to learn whether NRC Staff currently estimates this review will take 4 years in light of the procedural aspects of 10 CFR Part 60. But for planning purposes, the Department continues to believe it prudent to use the NRC estimates previously provided.

One Participant believes that developing five sites before one is selected is not necessary and, therefore, that the site characterization phase of the program can be completed in a shorter period of time. AICHE PS at 5 and 6. The site characterization and selection phase of the schedule conforms with the President's statement of 12 February 1980; DOE PS, App. A; mandating evaluation of four to five sites prior to site selection. Presently, the field activities in hard rock systems are not as far advanced as are the activities in basalt, salt, and tuff. Therefore, the selection of the first repository site for submission of a license application requires prior completion of the work in hard rock.

Several Participants have stated that the NRC should not have confidence that a repository will be available in the 1997-2006 time frame, because the Department purportedly has not adequately considered such things as time required to resolve institutional uncertainties and to accommodate for any prolonged public hearings, possible project reorientation, or extended public interaction. NECNP at 68; OH PS at 15 and 19. The Department acknowledges that contingency time is required in the schedule to accommodate such factors as are outlined above, but believes that an appropriate amount of time in fact has been allowed in the reference schedule. DOE PS, Fig. III-2. The Department's extended schedule; DOE PS, Fig. III-3; accommodates extensive

time for contingencies, such as possible need for exploration at the repository horizon prior to formal license application, an extended site selection process providing for long consultation and concurrence activities, longer time for preparation of the Department's formal NRC license application, extended NRC review, and delayed construction and checkout of the repository. The specific contingencies accounting for the extended schedule are presented in the Department's Statement of Position; DOE PS, Table III-7; and are summarized as follows:

Contingencies Added to Expected Duration for Specific Events

Repository Horizon Exploration	42 months
Site Selection Decision	3 months
Application Preparation	6 months
NRC Regulatory Review	12 months
Construction	12 months
Checkout Tests	<u>3 months</u>
Total	78 months or 6½ years

The Department considers it unlikely that all of the contingency periods assigned to each activity listed above will be needed.

The statement by some Participants that no contingency time is allowed for resolving institutional concerns is not true. State and local government, public, and special-interest group participation in this program is continuous, starting with the site exploration phase of the program, as shown on the upper part (line ID No. 11) of the two schedules; DOE PS, Figs. III-2 and III-3; respectively, and as discussed in the Department's Statement. DOE PS at III-20 to III-31. The 3 additional months allowed for a site selection decision in the extended schedule are for additional consultation and concurrence over and above the 15 months allowed in the reference schedule. The additional 12 months allowed for regulatory review over and above the 48 months allowed in the reference schedule are for a longer Atomic Safety and Licensing Board review where additional parties intervene in the NRC proceedings.

Another reason offered for lack of confidence that the schedules will be met is that a 17-year period (from now to 1997) is beyond the horizon of credible government planning efforts. CEC PS at 16. The Department wishes to note that the site characterization and selection activities that will take place in the next 7 years (to March 1987) represent the most complex phase of the total repository development program, since they involve many of the factors that could cause significant interruptions. The Department submits that it is not a major problem to plan for activities that will take place in the next 7 years. This has been done in sufficient detail in the schedules presented in the Department's Statement of Position. For the balance of the schedule from March 1987 to the time frame of 1997-2006, adequate details about contingencies have been made part of a repository development logic that consists of well-defined steps, including licensing, construction, and final checkout.

One Participant suggests that because of uncertainties in future governmental actions, resolution of social and institutional questions, and establishment of new technology, it is impossible to estimate now precisely when disposal in mined repositories will be available. USGS PS at 4, 5, 29. The Department recognized the uncertainties involved in implementing a program of this complexity, and therefore has presented a range (1997-2006) rather than giving a specific date for the availability of the first repository. Reasonable estimates of time required for resolution of uncertainties in future governmental actions and of social and institutional questions are included in the contingencies allowed in the extended schedule as described above. Regarding uncertainties in the development of new technology, the draft Earth Sciences Technical Plan; DOE PS, Ref. III-55; which was prepared jointly by the USGS and the Department, reflects joint DOE-USGS estimates that the major part of the technology will be completed by 1987. This is also shown on Line 1D No. 11 "Technology and Testing" of the two schedules presented in the Department's Statement of Position. DOE PS at III-81.

Another Participant indicates that, while it finds no fault with the logic underlying the assumptions of task times presented on the Department's schedule, history has seldom demonstrated that schedules for complex projects of this nature are achieved. NECNP PS at 67. Participant NECNP's statement that there is no fault with the logic and task times given

in the schedule is significant, because it demonstrates agreement with the Department's position that the steps leading to the availability of a mined repository can be defined. The Department, however, does not believe NRC should assess confidence in the schedules presented based on a Participant's general, undocumented impression of schedule estimates for unspecified past projects. As discussed above, the extended schedule presented in the Department's Statement of Position provides reasonable times for contingencies and thus provides confidence that the first repository will be available within the 1997-2006 time frame.

Delay caused by potential legal challenges is not specifically identified as a factor that could significantly influence the repository schedule in the Department's Statement of Position. This possibility is raised as a deficiency by the State of Wisconsin. WN PS, Leverage at 1. This factor was not discussed in the Department's Statement for two reasons: (i) although legal challenges may occur, it is not anticipated that such challenges will delay the program, and (ii), unlike statutorily mandated hearings, one cannot predict if and when law suits will be brought. If legal challenges occur at the site characterization stage, the Department anticipates that work will be allowed to continue while the legal issues are resolved by the courts. In the unlikely event that field work is stopped in one geographic area, the program can continue in another. Challenges commenced at the site selection stage will not affect the schedule, because it already allows for hearings before the NRC. DOE PS at III-85. In any case, there is enough flexibility in the schedule to accommodate delays caused by legal challenges to Department or Commission actions.

The State of New York states that the Department's projection that a repository will be available by the year 2006 appears contrived to meet the suggested deadline of 2007 in State of Minnesota v. NRC, the decision that prompted this proceeding. NY PS at 35. There is no basis for the statement made by the State of New York. Both the reference and extended schedules presented in the Department's Position Statement were developed by establishing a logic diagram, assigning a duration to each activity, and determining the critical path. With this procedure, and this procedure alone, the Department arrived at the time frame of 1997-2006.

A few Participants also discussed the schedule for the Department's spent-fuel storage program. They expressed concern regarding the Department's ability to bring away-from-reactor spent-fuel storage facilities on line by the time they are needed. One Participant, for example, points out that AFR's have still not been authorized by Congress. IL PS at 2. While the acquisition and/or construction of AFR's have not as yet been officially authorized by Congress, Senate passage of the Nuclear Waste Policy Act (S.2189) on 30 July 1980, provides an indication that such authorization may be forthcoming. Among other things, S.2189 would authorize the construction or acquisition of AFR storage facilities and the appropriation of funds for the initial AFR facility. This bill must now be considered by the House of Representatives. The Administration had sponsored authorizing legislation for AFR storage of spent fuel in both houses of Congress in March 1979. DOE PS at V-14. These bills were considered in developing the AFR storage provisions of S.2189.

Two Participants contend that the Department's conclusion that AFR storage facilities can be in operation in 1983 is unrealistic. OH PS at 4; WN PS, Deese at 17 and 18. Another Participant expresses concern that it may be optimistic to effect the conversion of existing AFR facilities for interim storage of spent fuel in 8 to 9 years because of resistance by local citizens and their State governments. NECNP PS at 69. The Department, in its Position Statement, estimated that AFR spent-fuel storage facilities can be made available commencing as early as 3-4 years after Congressional authorization. DOE PS at V-25. This schedule involves from 6 to 12 months of construction work connected with reracking, and the remainder of the time represents the allowance for acquisition and licensing; this means that only about 20% of the time needed for making this AFR storage capacity available is required for construction--the rest is due principally to licensing considerations. This should provide sufficient time to consider the legitimate concerns of local citizens and their State governments in the manner described in the Department's Position Statement. DOE PS at V-14.

NECNP also expresses the concern that the Department's plan and schedule would be significantly impacted if reracking of reactor storage basins could not be achieved in a timely fashion. NECNP PS at 46. Any delays involved in reracking reactor storage basins are not likely to significantly impact the Department's plans or schedule. The time required for reracking,

based upon TVA's experience, has been described as being only about 14 months after NRC approval. TVA PS at 8. (TVA operates 3 reactor units and has 14 other units in various stages of construction; this constitutes the nation's largest nuclear power program. TVA PS at 3.) During the period 1975-1979, the Commission licensed the expansion of 42 reactor storage pools. DOE PS at IV-28. Thus, this licensing process is well established and should not result in unanticipated delays. Moreover, the Department conducts periodic evaluations of the status and plans of utility spent-fuel storage programs, DOE PS at V-2, and thereby is able to identify any changes that might impact the Department's schedule so that any necessary adjustments thereto can be made on a timely basis.

The State of New York projects increased needs for AFR storage because of delays in repository deployment or through allowing the spent fuel to cool for a longer period prior to disposal; this Participant estimates that 18 AFR storage facilities would be needed (for 90,000 MTU) if the first repository were delayed until 2010 and that 35-67 facilities would be needed if there were a 50-year delay in repository availability. NY PS at 109-110.

The effects of given delays in repository deployment on AFR storage capacity requirements estimated by the Department in its Position Statement, DOE PS at VI-3, as follows:

<u>Initial Repository Startup Date</u>	<u>AFR Requirements</u>
July 1997	20,000 MTU
July 2002	44,000 MTU
July 2006	70,000 MTU

In the event it should not prove to be possible to meet the 1997 repository availability date, such would be apparent several years earlier, and the necessary plans could be made to accommodate any added AFR storage requirements. AFR storage facilities would not have to be limited to a capacity of 5,000 MTU; this capacity was selected as the reasonable economic size that would need to be built to meet storage requirements around 1990. DOE PS, Fig. V-6. Water pool storage could be expanded by the addition of pool modules at the AFR site to increase the storage capacity progressively as needed. Dry storage in caissons below grade or concrete storage silos would be particularly

suitable for storage of large quantities of spent fuel at a specific site; they represent more passive systems of storage, require less maintenance, and offer the flexibility of being readily expanded in small increments. DOE PS at IV-19. Moreover, dry storage facilities could be expected to be able to accommodate as much as 50,000-100,000 MTU at a given site. Thus, if large AFR storage capacities were to be required it would not necessarily require the number of AFR storage facilities suggested by the State of New York. Rather a much smaller number of facilities would be required through expansion of water basin type storage facilities or through the use of dry storage facilities.

In conclusion, the Department submits that the schedules for both disposal and storage in its Statement of Position represent an appropriate planning logic and adequately identify the activities and their durations (including contingencies allowed for prolonged public hearings, extended public interactions both in the site selection and development stages) to complete the projects in a reasonable timeframe. The factors presented by other Participants, as summarized above, are not sufficient to warrant a change in the Department's position regarding availability time frames for either AFR storage or disposal in mined geologic repositories. The time frame 1997-2006 is that within which there is reasonable assurance that the first repository will be available for receipt of nuclear waste.

II.A.11 Need to Consider Availability of Multiple Repositories

Two Participants believe NRC needs to consider problems associated with multiple repositories in this proceeding. Specifically, the State of New York suggests that ". . . a dozen or more repositories will be needed just to handle the existing wastes plus those to be produced by existing plants and defense programs," and that NRC must find confidence that all the necessary repositories will be available. NY PS at 18. The Department does not believe that consideration of availability of the first versus subsequent repositories would significantly impact the ultimate issue in this proceeding--the availability of disposal or storage facilities when needed. Nevertheless, it is possible to bound the problem of the number of repositories required in the foreseeable future. The actual number of repositories needed within a particular time frame will depend on such factors as the ultimate

growth of the nuclear industry, the thermal loading used for placement of waste, limitations on available space within the host rock, and the number of regions that may be designated to serve specific geographic locations. Based on recent nuclear power growth patterns and spent-fuel discharge rates, the Department estimates that from three to six repositories would be needed for disposal of spent fuel from a system of reactors that grows to a 250 GWe capacity by year 2000 and remains at that capacity to 2040.

The Interagency Review Group estimated that 3,700 acres, at most, might be required for geologic disposal of defense wastes through 2000; DOE PS, Ref. III-21 at D-21; which might represent two additional repositories. The key point to be made here, however, is that knowing the precise number of repositories needed would not significantly affect the Department's siting program, technology program, or licensing program, and hence, its capability to develop as many repositories as will be required. The siting program already includes investigations in several different regions, and plans for further expansion are cited in the Department's Position Statement. DOE PS at II-125. This coverage is likely to identify a significant number of suitable sites in widely divergent regions. The technology program, similarly, is developing a broad scientific basis of understanding capable of supporting any number of repositories. Finally, the licensing and construction of the repositories will be phased 3 to 4 years apart so that individual activities for 4 or more repositories would not occur simultaneously.

Rather than stressing that more than one repository is needed, and that this idea should be considered by the Commission, one Participant asserts that there will be a new set of technical, institutional, and organizational problems associated with "scaling up" to a disposal system which is capable of accommodating wastes from an expanding industry. NRDC PS at 78. This Participant claimed that the entire system must be (i) ". . . essentially error-free from the outset . . . ," (ii) that ". . . the organizational complexity of an expanded waste disposal program is not linear with its size . . . ," (iii) that ". . . increased dependence on human reliability requires that the organization be equipped with an 'error detector mechanism' . . . ," (iv) that ". . . the Department has not analyzed the impact of an expanded waste disposal system or the social structure of the communities

directly affected . . . ", and (v) that " . . . the cost to our civil liberties from an authoritarian waste disposal bureaucracy which decides which communities become perpetual hazardous dumping grounds may be too great for our society to bear" NRDC PS at 78 to 81. The State of New York alludes to similar problems of scale. NY PS at 19.

The Department acknowledges that overall disposal needs should be addressed and has provided a preliminary discussion of the interaction of several facilities in Part VI of its Position Statement. The Department also acknowledges that the impacts of multiple repositories should be studied further, and it intends to perform such work when it is possible to identify specific potential sites and when regional requirements--the definition of which will rely largely on the input from the elected leadership of this country through mechanisms such as the State Planning Council--are finally determined.

As a result of recommendations of the Interagency Review Group, the National Governors' Association, and others, the Department is sponsoring the investigation of factors that might dictate the appropriate placement of repositories on a regional basis in the country. When studies of these factors are complete and various options upon which regional siting could be based are described, the Department will provide information to the State Planning Council, the Congress, and the various States to allow the formulation of a National strategy for regional repositories and their combined effects. The wide dispersion of regionally based repositories will tend to mitigate any synergistic impacts. However, the exact nature of these combined effects will have to be considered in detail as part of siting decisions when they are made. The Department maintains, however, that no impacts greater than the linear combination of the impacts of individual repositories have yet been identified that would significantly affect confidence in the future development of repositories.

In conclusion, the Department maintains that with the limited number (three to six) of repositories needed there would be no significant impact on the siting, licensing, and construction phases of the program.

Several Participants raise issues concerning potential socioeconomic impacts that might result from the Department's waste management program. For example, one Participant expresses concern over the potential drain on public services. SHL PS at 3. Mississippians Against Disposal similarly cites supposed costs to communities for additional public services (e.g., education, police, fire, garbage, sewage, and medical) and for road maintenance and upgrading from the required outside workforce. MAD PS at 2,3. Another fears that a repository sited in a rural area near small population centers would result in a "boom-bust" situation and that major environmental impacts may be greater than suggested by the Department. WN PS, Leverance at 2. The State of Ohio asks if the Federal Government will reimburse a state for resulting costs. OH PS at 14. Mississippians Against Disposal similarly asks who will pay the costs of additional facilities and services required by affected communities and the costs of public information campaigns that will be necessary to resolve public doubts and fears. MAD PS at 3.

The adequacy of the Department's program to deal with socioeconomic impacts should be judged in light of the considerable time that exists (at least 11 years) before onset of the first substantive impacts that begin with construction. The Department recognizes that communities must carefully plan the management of these impacts, and the socioeconomic studies portion of the Department's program is being structured to provide to site communities timely assistance for this planning. In addition, the Department recognizes that this planning must take place as part of site selection and is structuring the program accordingly.

The Department recognizes that the mitigation of adverse impacts will involve judicious consideration of several larger issues such as public perceptions of risk, uncertainty, and inequitable distribution of risks (27). These factors are considered in sections II.A.8 and II.A.13, respectively, of this Cross-Statement.

The Department's policy regarding investigation of socioeconomic impacts is evolving and expanding to meet the problems discussed above. These efforts will be aided by other Federal agencies, by public input, by the State Planning Council, by the recently established National Academy of

Sciences Panel on Socioeconomic Criteria in Siting, and by the consultation and concurrence process. See Section II.A.4. of this Cross-Statement.

Principal components of the Department's socioeconomic program include:

1. Studying the nature of the problem, attitudes of the public, likely impacts of repository facilities and possible mitigation measures, and compensatory and incentive mechanisms (28-30).
2. Designing of a community development program to involve site areas in the planning and development of siting arrangements and impact mitigation (31, 32).
3. Supporting the State Planning Council as well as States now involved in the program in order to provide them with the capability for independent evaluation and review of the Department's efforts.
4. Actively soliciting expertise of other Federal agencies through cooperation on resolution of issues.

Recent studies of the potential socioeconomic effects of repositories identify and examine a range of impacts that may be incurred by repository communities according to differences in population density and degree of urbanization. To illustrate the order of magnitude of a repository project in terms of jobs and financial impact, it is noted that manpower needs can range from 1,200 to 3,100 people directly employed during the peak construction years, and from 900 to 2,300 people directly employed during the operational phase, depending upon the medium in which a repository is constructed. DOE PS, Ref. II-38 at 3.1.126 to 3.1.136; DOE PS, Ref. II-637 at 3-6 to 3-7. Estimates of construction costs in 1978 dollars range from \$1 billion to \$3.1 billion, and operating costs over the repository lifetime range from \$600 million to \$2.4 billion. The range in costs is also medium-dependent. The implications of these amounts in terms of (i) total project-related in-migrants (including primary and secondary workers and associated household dependents) and (ii) their needs for locally provided social services (health, education, sanitation, fire and police personnel, recreation areas, government services,

etc.) are also described for several different hypothetical settings and repository conditions.

Socioeconomic impact studies prior to site selection are concerned with ensuring that methods and procedures to be utilized in impact assessment are available, appropriate, and where necessary, refined to adequately detect the nature and magnitude of anticipated impacts. Methods and procedures to project demographic, fiscal, economic, and public service impacts are currently being examined and refined by researchers at Oregon State University, Texas A & M University, and North Dakota State University, among others. Studies of the mitigation and compensation components are being undertaken at Oak Ridge National Laboratory. As the site selection process proceeds to specific locales, impact analyses will be performed at that level. In particular, with regard to impacts associated with the proposed WIPP project in New Mexico, the Department has provided funds for a socioeconomic study at the University of New Mexico, which is being directed and co-funded by the Department of Energy and Minerals of the State of New Mexico. This study includes alternatives to property taxation to minimize impacts associated with federally owned facilities. A final report from the University of New Mexico is expected during the last quarter of 1980.

Socioeconomic impacts are site-specific and will be fully addressed during the NEPA process. DOE PS at III-40 to III-41. The Department realizes that impacts on a rural area could very well be more severe than in areas of higher population density. In fact, this same observation has been made in the Draft Environmental Impact Statement for Management of Commercially Generated Radioactive Waste. DOE PS, Ref. II-38 at 3.1.129 and 3.1.132. In response to the State of Wisconsin, however, the Department does not believe a "boom-bust" situation will occur, since the construction and operational phases of a repository will likely span several decades.

At present, the economic or social benefits for localities in which repositories may be sited would be the same as those typically associated with any relatively large Federal project. They would result primarily from the channeling of outside financial resources into the community through repository worker's salaries and payments for supplies and services that can be locally supplied. Local and State governments also would be expected to

gain by the increased tax revenues from the increased expenditures throughout the community.

One Participant cites the Federal in-lieu-of-taxes arrangements with communities at national laboratory sites and the Congressional bills proposing impact assistance at large energy facilities as models for special treatment of communities affected by Federal activities. UNWGMG-EEI PS, Doc.2 at IV-12. Some mitigation of typical work force impacts at Federal projects is available under current law. To deal with typical impacts, and considering that current law does not allow State or local governments to tax federally owned land, existing legislation (i) allows the Department to make payments in lieu of taxes, generally based on taxes which would have been payable for such property in the condition in which it was acquired (42 U.S.C. 2208) and (ii) provides for financial assistance to those local educational agencies upon which the Government has placed financial burdens (20 U.S.C. 236 et seq.). Also, Section 168 of the Atomic Energy Act of 1954 (42 U.S.C. 2208) as amended, permits the Department to make impact assistance payments to mitigate special burdens. The formula for calculating such payments must include consideration of the benefits accruing to the State or local governments; i.e., a cost-benefit analysis must be conducted.

In the past, the Atomic Energy Commission (AEC) was empowered to finance directly community services such as fire protection and water treatments at communities such as Los Alamos, New Mexico, and Oak Ridge, Tennessee, where the original existence of the community was due primarily to the presence of the AEC program. This precedent could perhaps be applied in allowing for direct financing of community services by the waste isolation program.

The Department agrees that the matter of incentives to encourage States and localities to accept siting of nuclear waste repositories in the area is in need of more examination. The only significant incentives presently derive from the potential benefits described earlier; i.e., jobs and prospects for increased business activity. New enabling legislation to expand the Department's authority to fund local communities and states for these purposes may be needed. Just what the options are and the advantages or disadvantages of each are being pursued in the Department's program and elsewhere

(33, 34). For instance, AICHE suggests a fund created by placing an incremental charge on the storage and disposal fees. AICHE PS at 6. This may be an equitable transfer that would provide a steady source of economic support to local community governments.

The Department also agrees that recognition of the need for assistance to impacted communities is needed and welcomes consideration of this issue by Congress in its hearings on the proposed Atomic Energy Act Amendments of 1980 (HR 6390), regarding high-level waste repositories. Further evidence of Congressional interest is provided by the fact that the U.S. Senate passed an extension of energy impact assistance to include nuclear spent-fuel storage and waste facilities in the Department of Energy Authorization Act for Fiscal Year 1981-Civilian Applications (S.2332). The Department attaches high priority to the satisfactory resolution of these problems and will continue to pursue them.

The State of New York suggests that the Hearing Board on the Draft Environmental Impact Statement on Management of Commercially Generated Radioactive Wastes; DOE PS, Ref. II-38; found that inadequate attention had been given to social and political issues in the Department's EIS. NY PS at 75. The Department is responding to the Hearing Board comments in preparation of the final document (to be published in the near future).

The Department recognizes the importance of socioeconomic impacts. A program to assess and mitigate these impacts is under way. Experience with addressing and mitigating socioeconomic effects at Federal installations similar in size has proven successful in the past. The ample time from the present to the time of actual repository construction will permit socioeconomic impacts assessment and their avoidance, mitigation, or compensation.

II.A.13 Equitable Distribution of Risks and Impacts

Several Participants question the viability of the Department's program and schedules, claiming that they rely on an inequitable distribution of risks and benefits that will ultimately impede or stymie the program. NRDC PS at 69; NY PS at 69, 70. Some claim, for example, that the States will see themselves as being unduly burdened (e.g., they will be exposed to risks of

being near the repository or alongside a transportation corridor) without receiving commensurate benefits. NRDC PS at 70. This, it is asserted, will result in resistance or reluctance to cooperate. For example, NRDC raises general questions about whether risks would be shared equally by all areas of the nation. Id. According to the State of New York, failure to address perceived unequal distribution of risks could arouse intense opposition. NY PS at 69, 70.

Clearly, the combination of the cost of disposal in mined geologic repositories and the very special conditions to be required of qualified sites will not allow these facilities to be geographically distributed so as to exactly equalize risk (e.g., by proximity) among the entire citizenry or among selected population elements judged to "benefit" from the generation of the wastes. Thus, there is an issue with respect to perceptions of equity in the matters of siting. Resolution of such an equity issue and even its objective definition constitute a complex matter in modern industrial society. With respect to confidence that this issue can be resolved in a time frame consistent with program schedules, at least four general points should be made: First, the Federal Government has recognized the need to provide some equity by examining the concept of regional repositories and by developing allowances and institutions to mitigate, compensate, or avoid socioeconomic impacts. Second, the distribution of benefits against which risks are often compared is far more diffuse in a modern national economy than is immediately recognized. Third, in an interdependent society, practically all citizens are exposed to risks from some activities that do not themselves provide offsetting benefits; but, conversely, these same citizens receive benefits from activities whose risks they do not fully bear. Overall, these situations tend to be offsetting. Fourth, the margins of safety implicit in a conservative technology based on multiple barriers allow one to expect risks which will be very much less than the general public presently believes.

As directed in the President's statement of 12 February 1980; DOE PS, App. A; the Department is proceeding to identify candidate sites at several locations and in different media. DOE PS at III-8. This objective also follows the recommendation of the IRG, which stated,

Regional siting would reduce the transportation requirements and attendant risks, provide redundancy

that would hedge against the possibility of operational difficulties causing unexpected repository shut-down and could assist in repository siting by distributing the burden across more than one location. DOE PS, Ref. III-21 at 52.

To the extent permitted by availability of suitable geologic sites, the Department intends to consult closely with the State Planning Council, State Governments, and the Congress to formulate a national strategy to provide disposal services to defined regions of the country. A combination of technical and nontechnical considerations will influence the delineation of regions. The need to consider multiple repositories and factors affecting their distribution is discussed further in Section II.A.11 of this Cross-Statement.

Some Participants feel that those who live near a waste repository bear a greater risk in proportion to their benefit than those removed from the site, whereas some may not benefit from nuclear power at all. NRDC PS at 70; WN PS, Kelly at 20. The State of Wisconsin survey found some public support for siting a repository near a nuclear plant site. The Department submits that benefits of nuclear energy are diffuse. However, it is difficult to determine which members of society are directly or indirectly enjoying such benefits. Many people utilize products made through the use of nuclear-generated electricity, just as many of us use the products of steel mills, oil refineries, paper mills, chemical plants, etc., whether or not we live near the facilities.

The siting of facilities that potentially impose impacts or risks on the host community is not unprecedented. Often it is possible to address local concerns in part through various compensatory measures, in part through impact mitigation, and in part through involving the host community in the decision process for siting the facility. These measures are discussed further in Sections II.A.4, II.A.8, and II.A.12 of this Cross-Statement. Quite often the necessary negotiations have been difficult, disruptive, and fraught with emotional contention. Nonetheless, where the needs are real and the process patently fair, the facilities have been sited. It is obviously not guaranteed that such procedures will automatically be successful in the case of radioactive waste repositories, but, on the other hand, the existence of public opposition does not uniquely indicate that siting procedures will fail. Also, experience suggests that hostility often subsides and acceptance

follows where operations extend no particular inconvenience to the locality. This process of accommodation will be eased by the general realization of the precautions to be taken and the minimal risk to be expected. A discussion of the nature and magnitude of actual risk associated with nuclear waste management is found in Section II.B.1 of this Cross-Statement.

II.A.14 Reasonableness and Accuracy of Costs of Waste Management

Some Participants express concern about the waste management program costs as estimated in the Department's Position Statement. NECNP PS at 67,69 and 121-122; NRDC PS at 81; CDC PS at 8; SHL PS at 3. NECNP specifically suggests that cost estimates are limited to those involved only with the physical design and construction of waste facilities and, therefore, seem to greatly underestimate the total cost of waste disposal. NECNP PS at 69. Furthermore, others claim that the Department's summary in Part VI of its initial Statement does not mention R&D costs and that the primary DOE reference cited in that Part is preliminary; NECNP PS at 70; that decontamination and decommissioning costs are not included; DE PS at 6; and that the economic justification for interim storage is not provided. OH PS at 20, 21.

As noted by the New England Coalition on Nuclear Pollution, it is not the purpose of this proceeding to accurately quantify the total cost of the program. NECNP PS at 70. Rather, the intent is to examine the essential cost elements involved in order to ascertain whether the total cost of interim storage and disposal will be prohibitively expensive, the test the Commission said it will apply in this proceeding.* With this goal in mind, the expected

*In its Notice of Proposed Rulemaking commencing this proceeding, the Commission said:

. . . this proceeding is not designed to reach quantitative conclusions about waste repository impacts or performance. The Commission will consider economic issues in this proceeding in the same fashion such issues were considered in the recent fuel cycle rulemaking: namely, a waste disposal model will not be considered realistically available if it would be prohibitively expensive to build and operate such a proposed facility. 44 Fed. Reg. 61372, 61373 (1979).

cost levels of repository R&D, construction and operation, and decommissioning are provided in the Department's Statement. DOE PS III-69 to III-79. The eleven pages of cost information on packaging facilities, geologic repositories, and associated auxiliary facilities contain estimates of R&D, capital, operating, and equipment replacement costs, as well as the sensitivity of costs to variations in types of geologic media, thermal loading, and repository size. Id. Ten supporting references are also cited. A summary of cost information for a new away-from-reactor storage facility including capital, operating, and decommissioning costs is included. DOE PS at V-25. The Department also provides in its Position Statement a summary of the estimated cost of the integrated storage, transport, and disposal operation, referencing the latest applicable derivation of the preliminary charge estimates thereof and commenting on the prospective effects of program changes thereon. DOE PS at VI-13. The various references cited by the Department contain detailed additional information.

In July 1978, the Department issued a preliminary estimate of the charges for spent-fuel storage and disposal which amounted to about 1 mill/kWh, in 1978 dollars. DOE PS, Ref. VI-5. The methodology used to calculate the estimated storage and disposal charges is similar to the one that has been used for many years to determine the charge for uranium enrichment services.

Basic to the charge calculation methodology is the principle that the Federal Government should be reimbursed over a reasonable period of time for all costs relevant to the services provided. This has been interpreted to mean that the present value of all applicable revenues must equal the present value of all relevant costs. Stated another way:

$$\text{Discounted Costs} = \text{Discounted Revenues}$$

All costs and revenues are expressed in constant dollars. Since revenue is defined as charge multiplied by quantity and since the charge is defined to be a constant over the campaign period, discounted revenue can be expressed as:

$$\text{Discounted Revenue} = \text{Charge} \times \text{Discounted Quantity}$$

As a result, the desired charge in terms of dollars per unit quantity can be calculated by the formula:

$$\text{Charge} = \frac{\text{Discounted Cost}}{\text{Discounted Quantity}}$$

Discounted Quantity is determined by first projecting annual transfers of spent fuel to the designated site, then discounting time to the present year at the accepted Government discount rate, and finally summing the discounted quantities. Discounted costs are determined by first projecting annual cash expenditures for capital and operating costs for each cost center including those dependent on material flows, then discounting them to the present year at the accepted rate, and finally summing the discounted annual costs by cost centers.

As indicated in its Statement, the Department is developing updated estimates for the charge for storage and disposal services. This report containing these estimates should be issued in the last quarter of calendar year 1980. However, in the interim, preliminary figures for the charges for spent-fuel storage and disposal which are based on the information from the Department's Position Statement can be provided. An estimate of the cost of spent-fuel storage and disposal has been made using the following:

1. Capital, equipment replacement, operating and decommissioning costs of geologic repositories. DOE PS at III-75.
2. Capital, operating and decommissioning costs of waste packaging facilities. DOE PS at III-79.
3. Capital, operating and decommissioning costs of AFR storage facilities. DOE PS at V-25.
4. Research and development costs. DOE PS at III-69.
5. Cost of transportation of spent fuel from AFR storage to repositories. DOE PS, Ref. VI-5.
6. Cost of government overhead associated with storage and disposal of spent fuel. DOE PS, Ref. VI-5.
7. Unit cost methodology which takes into consideration the time value of Federal funds invested in the spent fuel management facilities. DOE PS, Ref. VI-5.

Using the methodology described above, the charge for both storage and disposal services would be about \$325/kg to \$375/kg of spent fuel in 1980 dollars. This is equivalent to 1.3 to 1.5 mills/kWh. Those customers requiring only disposal services would pay about \$200/kg to \$250/kg of spent fuel or about 0.8 to 1.0 mill/kWh. A significant portion of these charges is attributable to the indirect costs. These costs are, in effect, carrying charges on expenditures which are made before the services are in operation and revenues are collected. This is analogous to interest charges on an outstanding loan. The weighted average cost for storage and disposal of all spent fuel would fall between these values. For example, in a situation where only 15% of the spent fuel is stored in AFR storage facilities, the average for all users of disposal or storage and disposal would amount to about 0.9 to 1.1 mills/kWh.

This range of values is a very small fraction of the cost of delivered electricity which is about 30 to 40 mills/kWh. DOE PS at VI-14. The UNWVG-EEI states that such a cost (1 mill/kWh) does not represent a major contribution to electric power production expense and accordingly does not present a major obstacle to the implementation of a spent-fuel waste management program. UNWVG-EEI PS, Doc. 1 at 19 and 23.

One Participant cites a 1978 study conducted by MHB Technical Associates (35) which it alleges shows that disposal costs could add from 1.2 to 8.0 mills/kWh to the cost of electrical generation. NECNP PS at 86. The MHB study concluded that the costs of spent-fuel storage and disposal would more likely be 3.4 mills/kWh or as much as 8.0 mills/kWh. This study was reviewed and analyzed by the Department in early 1979 at the request of Congressman Edward J. Markey (36). Serious problems with the financial analysis were identified; for example, the MHB study employed an unrealistic interest rate compared to escalation, and doublecharged interest on unrecovered government funds--which considered alone combines to reduce the 3.4 mills/kWh figure to about 2.1 mills/kWh. It was further concluded that once adjustments were made to the MHB figures for rather obvious errors and unrealistic assumptions, the MHB results and those of the Department's July 1978 report were not significantly different.

The State of Ohio alleges that the Department has failed to justify AFR storage on economic grounds, stating that the Department's estimates for AFR storage are incomplete and that they are based on the assumption that a repository will be available in 1996. OH PS at 20-21. Nevertheless, this Participant agrees that the cost of AFR storage is only a small percentage of the total fuel cycle cost. Id. Further this Participant contends that a comparison between the cost of AR and AFR storage (including the shipping considerations associated therewith) was not provided. Id. It is the Department's position that it is not the role of this rulemaking proceeding to establish whether or not AFR storage facilities are necessary or more economically attractive than other alternatives, but rather to establish whether necessary storage capacity can be made available when and as required and at costs that do not seriously impact the overall cost of electricity generation.

The Department has, however, conducted studies of the comparative costs and environmental effects of alternative storage methods, which have included a comparison of the cost of AFR and AR storage (37). See also DOE PS, Ref. V-23. The Department has determined that, whenever possible, fuel storage requirements will be met by reracking existing reactor basins and/or by transfer to available space in other capacity reactor basins in as much as this course of action is more economical and is faster than that represented by the construction of AFR storage facilities. However, once it becomes necessary to obtain storage capacity in addition to that provided by reactor basins, it is more economical to build AFR storage facilities than new storage facilities at reactors. The Department's studies have shown that only when a utility requires an annual storage capacity for 100 MTU or more (equivalent to the output of three or more reactors) can self-storage in new facilities built at a reactor location begin to compete economically with AFR storage facilities. DOE PS, Ref. V-23. The Department's program for interim spent-fuel storage is intended to provide storage space only to the extent that utility companies cannot economically expand their existing storage facilities or establish new facilities on a reasonable and economic basis.

The Department's estimates of the cost of construction and operation of an AFR storage facility having a capacity for storing 5,000 MTU as spent fuel are based on a conceptual facility design. DOE PS, Ref. V-23. The Department believes that the costs set forth in its Position Statement for

construction, operation, and decommissioning of an AFR storage facility are conservatively high. These costs are in the same year dollars as is the estimate of unit costs. DOE PS at V-25 and Ref. VI-5. Therefore, the date of availability of the repository will not change the capital, operating, and decommissioning costs of a specific away from reactor storage facility.

A delay in repository availability would have the effects of increasing the prospective storage capacity that would be needed, increasing the average time spent fuel would have to be stored, and increasing the amount of fuel stored. While this would result in a larger total investment in facilities and larger total operating expenses, the unit cost of away from reactor storage would decrease slightly due to economies of scale and improved storage facility utilization (38).

The State of Ohio also states that it is not clear whether transportation costs are included in the Department's estimates of storage cost. OH PS at 20. The costs for transportation of spent fuel from storage to a repository are included in the Department's estimates of the cost of storage and disposal of spent fuel. DOE PS, Ref. VI-5.

The State of Ohio further states that the prospect of having to store a 40-year accumulation of spent fuel at a reactor site for an indefinite period of time after the reactor has ceased operation would produce an entirely different economic picture for nuclear power as an energy source than if such storage were not necessary after the termination of reactor operations. OH PS at 21. The Department's waste management program is directed at placing the first geologic repository in operation during the 1997-2006 time period. DOE PS at III-85. If the first repository is available in 1997, no spent fuel would need to be retained at the site of any reactor more than 40 years past its start-up, since no commercial reactor was in operation in 1957. If the first repository is available as late as 2006, and assuming no other storage is available at that time, the spent fuel from only four small reactors might have to be retained on site for more than 40 years past their start-up; if no other storage were available, the longest retention could amount to 46 years past start-up, or 6 years after completion of 40 years of operation (39). Accordingly, the premise that on-site storage would be required indefinitely is in error. Moreover, in any instances where interim storage is continued after termination of reactor operations, there would be only a small incremental

cost involved. This incremental cost would consist of the additional cost of security protection, operations and monitoring which is in excess of that which would otherwise be needed for the reactor facility if immediate dismantlement is not effected. For example, following termination of operations, the portion of the reactor facility not essential for safe spent-fuel storage might be maintained in a state of protective storage for a number of years. Such an incremental cost for storage would involve primarily labor costs and would be in the order of \$1 million a year. This corresponds to about 0.005 mill/kWh for each year of storage past termination of reactor operation. This cost is insignificant compared to the cost of power production.

In regard to the cost of interim storage, including the cost of locating, constructing, and operating facilities, the State of Delaware alleges that the Department assumes AFR storage costs will be borne by the Federal Government. DE PS at 5. The Department's program is not based on the Federal Government's bearing the costs of AFR storage. Rather the Department's program is based on the acquisition or construction of AFR storage facilities using Federal funds and the recovery of such funds, along with interest and the costs incurred in operations, by the Department through charges made to users. Costs will be recovered through fees paid by utilities and will ultimately be borne by those who benefit from the activities generating the wastes. DOE PS at VI-13.

In conclusion, the Department submits that it has considered the essential cost elements for storage and disposal of spent fuel and concludes that the cost is a relatively small portion of the cost to produce electricity. Because this cost is not prohibitively expensive, it cannot be said that the Department's waste management program is not realistically available. See 44 Fed. Reg. 61372, 61373 (1979).

II.A.15 Exploratory Activities at Federal Reservations

One Participant claims that there is a contradiction between the Department's ongoing exploratory activities at Federal reservations, such as the Hanford reservation, and the site selection process which is considering multiple sites and media. WN PS, Deese at 3, 4. Specifically, the Participant alleges that the Department's activities in basalt at the Hanford

reservation are inconsistent with a " . . . carefully designed physical science program that screens many areas systematically. . . ." Id. Based on this reasoning, the Participant implies that the Department's site selection process is not in conformance with the President's Statement of 12 February 1980. DOE PS, App. A.

The site selection process described in the Department's Statement, DOE PS at III-8 to III-24, is in compliance with the President's Statement of 12 February 1980. As specifically discussed in the Department's Position Statement, the initial steps in a National Screening Survey can be structured in a number of ways. DOE PS at III-15 to III-17. The consideration of current land use to identify regions for further studies and reference to both the Hanford Site and the Nevada Test Site are discussed in the Department's Statement. DOE PS at III-16. The consideration of Department of Energy dedicated lands is also specifically identified in Figure III-4 of the Department's Position Statement. DOE PS at III-14. Consideration of Department lands that are already dedicated to the handling of radioactive materials is most appropriate and prudent. The Department agrees, however, that application of siting criteria and judgment of site suitability should be equally as rigorous for these lands as for other regions under investigation.

II.B TECHNICAL ISSUES RELATED TO DISPOSAL

The Statements of Position filed by the other Participants express a range of views regarding the technical viability of mined geologic disposal of radioactive waste. Although a significant number of Statements endorse and enhance the technical basis for the conclusions regarding disposal set forth in the Department's Statement of Position, other Statements assert that certain unresolved technical issues preclude a finding of confidence at this time. The Department, as noted previously, has performed a detailed review of all of the Statements filed. In this portion of the Cross-Statement, the technical issues related to disposal raised by the Participants are addressed by subject area.

II.B.1

Period of Time for Which There Should Be Reasonable Assurance
of Waste Containment and Isolation

Perhaps the most misunderstood aspect of radioactive waste disposal is the periods of time for which there should be reasonable assurance of waste isolation and containment.* Unfortunately, that misunderstanding is evident in some of the Statements of Position filed by other Participants in this proceeding. As shown below, the periods of concern are much shorter than some have suggested.

Several Participants take exception to the time periods contained in the Department's proposed containment and isolation performance objectives. They contend that the time periods are understated. The Department's proposed objectives state:

1. Waste containment within the immediate vicinity of initial placement should be virtually complete during the period when radiation and thermal output are dominated by fission product decay DOE PS at II-7.
2. Disposal systems should provide reasonable assurance that wastes will be isolated from the accessible environment for a period of at least 10,000 years with no prediction of significant decreases in isolation beyond that time. DOE PS at II-9.

When spent fuel first is placed in a repository its radioactivity content (and therefore its toxicity) will be at its highest point while in the repository. However, as discussed in the Department's Statement, the radioactivity content of spent fuel will significantly diminish within the first several hundred years primarily because of the decay of fission pro-

*The Department's Statement of Position, DOE PS at II-6, contains the following definitions of "isolation" and "containment":

Isolation means segregating wastes from the accessible environment (biosphere) to the extent required to meet applicable radiological performance objectives.

Containment means confining the radioactive wastes within prescribed boundaries, e.g., within a waste package.

ducts. DOE PS at II-8. This is the so-called period "dominated by fission product decay." During this period, the wastes should be "contained" tightly within the package in which they were placed because they then pose their greatest threat to the public health and safety due to the greater thermal driving forces and radiotoxicity. After this period, the radioactive elements will be significantly reduced in activity and be more nearly like natural elements found in the Earth today. At that time, they become of less concern because the risk to the general public associated with the wastes is very small and, in fact, similar to risks associated with elements that already have existed in concentrated ore bodies for all the years people have lived on Earth. Nevertheless, because they could pose some threat to the public health and safety, they should be "isolated."*

The first issue to be considered is the definition of the period of time during which waste "containment" should be virtually complete. As stated above, after the period dominated by fission product decay, there is less concern about the radioactive material placed in a repository. This is the basis for the Department's proposed performance Objective 1 above. Two Participants criticize the Department for not adopting the NRC Staff's standard of 1,000 years as set forth in its "strawman" technical requirements (40) as the period of concern about containment. NRDC PS at 30, 32, 37; MN PS App at 6, 9, 10. As previously discussed in Section II.A.7 of this Cross-Statement, it is inappropriate to utilize the NRC Staff's "strawman" criteria as a basis for judging the Department's program in this rulemaking proceeding. It should be recognized, however, that, for the most part, the Department's proposed Objective 1 already is consistent with the thrust, if not the words, of the NRC Staff's advance notice. For example, in proposing that waste packages contain material for at least 1,000 years after decommissioning, the NRC defined the 1,000 year period as the "period of time for which the relatively short-lived fission products dominated the hazard" (40). Although the Department submits that it is premature to establish the absolute value of 1,000 years for this requirement, the NRC Staff's basis for its draft

*This approach ensures consistency with the Interagency Review Group's recommendation that nuclear waste be isolated until it poses no significant threat to public health and safety. DOE PS, Ref. II-2.

requirement, as indicated by this quotation, is identical to the Department's containment objective.

Other Participants also generally agree that the appropriate quantification of the "period when radiation and thermal output are dominated by fission product decay" is between 500 and 1,000 years. UNWGMG-EEI PS, Doc. 1 at 13, UNWGMG-EEI PS, Doc. 2 at I-3; SE2-CN PS at 6; ANS PS at 14. Thus, there does not appear to be any substantive disagreement in this proceeding about the definition of the period of time during which waste "containment" should be virtually complete. The Commission therefore should use the Department's proposed Objective 1 above in assessing the technical basis for "containment" provided by mined geologic disposal.

The second issue to be considered is the definition of the period of time during which there should be "isolation" of the wastes. Two Participants assert that the 10,000 year period defined in the Department's isolation objective is not appropriate based on their concerns about toxicity, radionuclide content, and risk versus time. NY PS at 4, 20, 21, 30; CDC PS at 10, 11. As indicated above, the period required for "isolation" is of longer duration than the period required for "containment." Defining an appropriate "isolation" period requires an examination of radiological hazard or risk versus time. To derive an appropriate level of hazard, the Department compared the toxicity of high-level nuclear waste with that of natural uranium ore deposits from which the nuclear fuel originally was derived. DOE PS at II-11 to II-12.

Some calculations indicate the relative toxicity of the waste repository to be less than that of a 1% uranium ore deposit in 3,200 years. DOE PS at II-12. Such calculations are assumption-dependent. For example, the assumed proportions of interstitial rock considered to be part of the repository, or the size of the uranium ore body, could significantly affect the results. While similar assessments indicate that the relative toxicity of the repository becomes less than that of a typical uranium ore deposit over much shorter time periods; DOE PS, Ref. II-11; AIChE PS at 4; ANS PS at 13; SE2-CN PS at 6; evaluations that focus on the canister contents* conclude

*If the waste remains confined to the canister, of course, discussions of isolation are moot since containment would be complete. Once leaching of radioactive materials starts to occur, the approach utilized in the Department's Statement; DOE PS at II-12; would be more appropriate.

that much longer isolation times are required. Perhaps the most sophisticated calculations utilize the retention quotient* (RQ) approach. UNWGMG-EEI PS, Doc. 2 at I-18. This analysis indicates that the waste repository becomes less toxic than an equivalent uranium ore body in approximately 500 years.

Therefore, although such calculations are assumption-dependent, most evaluations indicate that, during the first 10,000 years, the radiological hazard due to spent fuel placed in a repository will decrease to approximate the levels of radiological hazard associated with naturally occurring ore bodies. DOE PS Ref II-23. This approach has been accepted by two other Participants as an appropriate indicator for this purpose. SE2-CN PS at 6; UNWGMG-EEI PS, Doc 2 at I-3, I-8. The rationale for using it is based on the fact that risks due to the existence of natural ore deposits have been experienced during man's entire history. Equivalent risks should therefore be considered reasonable. For this reason and the others set forth in the Department's Statement, DOE PS at II-9 to II-15, the Department proposes 10,000 years as an appropriate period of isolation. DOE PS at II-12. The Department submits that the Commission should use the Department's proposed Objective 2 above in assessing the technical basis for "isolation" provided by mined geologic disposal. It is noted that at least one Participant sees the 10,000-year time period as excessively conservative. AICHe PS at 4.

It also should be noted that the isolation objective is not confined to a period of 10,000 years alone. The objective also states that there should be no prediction of significant decreases in isolation beyond that time. For a specific repository, radionuclide distributions and concentrations would be estimated over much longer time periods (e.g., a million

*The Retention Quotient (RQ), as described in this Participant's Statement; UNWGMG-EEI PS, Doc. 2 at I-18; is equal to the reciprocal of the fraction of the total inventory which must reach a receptor (man) in order to give that receptor the annual dose limit selected:

$$RQ = \frac{Q_i}{DF_i}$$

Where:

Q_i = total inventory of isotope i in repository or ore body (curies)

DF_i = isotopic dose factor (curie of isotope i required to produce selected annual dose).

years) in order to ensure that there are no "reasonably foreseeable" situations that would lead to unacceptable doses. The very long-term requirement should be to provide an analysis of system performance, i.e., isolation should be assured for a ". . . period of at least 10,000 years with no prediction of significant decreases in isolation beyond that time." (Emphasis added.) DOE PS at II-9. As noted in the Department's Statement, the uncertainties in predicting conditions on Earth very long times into the future limit the time frame over which "reasonable assurance" of isolation can be provided. DOE PS at II-11. While it is true that some of the original isotopes placed in a repository will still exist after periods as long as a million years, the concentrations and toxicities of these residues have been clearly shown to be extremely small when compared to numerous naturally occurring conditions which abound on the Earth. Also, the very low hazard provides no basis for requiring high levels of assurance beyond 10,000 years. It is absurd to require that the residues of man's activities be less significant than the natural condition of Earth. There is therefore no basis for a 1-million year isolation objective as suggested by the State of New York. NY PS at 4.

Some confusion apparently arose over a misreading of the Department's containment objective vis-a-vis a statement in the Draft Environmental Impact Statement for the Management of Commercially Generated Radioactive Waste; DOE PS Ref. II-38; that high-level waste concerns span a million-year time frame. A discussion of the relative significance of million-year considerations is given in UNWGMG-EEI PS Doc. 3 at 4-1. That discussion concludes, based on the most reliable and realistic analyses of long-term repository performance, that not only would the maximum calculated consequences due to postulated system failures not be realized for hundreds of thousands to millions of years in the future, but that such maximum consequences would be only a small fraction of natural background radiation and, in any case, no greater than those experienced from some naturally occurring ore bodies. The Department's evaluations indicate equivalent results. DOE PS at II-224 to II-226.

Another traditional but technically inappropriate approach for determination of the required duration of isolation is suggested by the State of New York. NY PS at 20. This approach applies the 10 times half-life "rule of thumb" to plutonium-239 (which has a half-life of approximately 25,000

years), to show that a 250,000-year period is required for this material to decay to "innocuous" levels, regardless of its initial inventory or the isolation system characteristics. This issue was specifically considered in the Department's Position Statement. DOE PS at II-10. Such a requirement exceeds conditions naturally occurring on the Earth. Some of the radioactive materials in the wastes with extremely long half-lives are merely those which constitute the original uranium ore (e.g., U-238, which produces radon by decay). The State of New York's approach in essence thus would require that all toxic materials handled by man completely disappear for their disposal to be effective. By placing materials within carefully sited and properly constructed repositories, the likelihood of these materials escaping the multiple barriers will be less than for many examples occurring in nature.

Participant Lochstet expresses specific concern over the potential radiological consequences of iodine-129 and the radon-222 resulting from decay of uranium-238 in the spent fuel and concludes that because these impacts would be severe and unacceptable, isolation periods longer than 10,000 years are required. Lochstet PS at 2, 3. See also II.B.3.4 of this Cross-Statement for a discussion of related concerns expressed by Dr. Lochstet. Dr. Lochstet presents a calculation of the long-term impacts of uniform dilution into the biosphere of all the iodine-129 to be accumulated in all high-level waste by the year 2000. His computation, assuming uniform exposure to 4 billion inhabitants of Earth, indicates an annual population thyroid dose of 127 person-rem. This result is then integrated over "the total decay period for the iodine-129" to yield an estimated 5,000 to 10,000 fatalities. Both Dr. Lochstet's assumption of uniform distribution of iodine-129 to the world population and the integration of health effects over the iodine-129 decay period are meaningless calculations because (i) there is no physical mechanism that could distribute the waste to the whole world as Dr. Lochstet assumes, and (ii) Dr. Lochstet ignores the other iodine uptake mechanisms that would compete with human receptors for I-129. Also, given the extremely low specific activity of iodine-129, and the large environmental pool of stable iodine, it is virtually impossible to produce doses that would be important when compared with normal variations in background radiation. DOE PS, Ref. II-28. Dr. Lochstet's computation is clearly an exercise in numerology that ignores the real world. For example, using his assumptions, the individual dose Dr. Lochstet

would attribute to iodine-129 (3×10^{-8} rem/year from iodine-129) is only one one-millionth of the average dose now individually experienced from naturally occurring potassium-40 in the human body.

The American Nuclear Society goes even further than the Department has, by calling also for comparison of the potential risks from spent fuel with those from other toxic materials (not merely uranium ore) that are naturally found in the Earth, such as barium or arsenic. ANS PS at 14. A summary of related comparative risk analyses is found in the UNWGM-EEI Statement of Position. UNWGM-EEI PS, Doc. 3 at 1-2, 1-4. Several other Participants have also utilized comparative risk evaluations in discussing the acceptability of the risks of nuclear waste disposal. ANS PS at 14; NfE PS, Dornsife at IV.2-14 to IV.2-17; AIF PS at 4, 21. The thrust of their discussions is that many currently accepted activities involve non-radioactive toxic materials that present risks comparable to or greater than those associated with nuclear waste disposal. For example, the Atomic Industrial Forum concludes that the risk of a fatality resulting from nuclear waste is only 0.03% of that associated with a comparable coal-fired operation. AIF PS at 4, 21. These discussions provide additional support for the Department's position that the approach to isolation of nuclear materials it has described is appropriate.

All above-discussed comments relating the comparative risks of nuclear waste management and those of more routinely accepted activities and conditions attempt to use quantitative comparisons. These assessments indicate that, on a quantitative basis, the risk of nuclear waste will be reduced to minimal levels with properly sited and constructed geologic repositories. The Department of Energy asserts that the Department's proposed Objectives 1 and 2 set forth with their bases, DOE PS at II-7 to II-20, are reasonable for use in this proceeding and that the arguments of other Participants identified herein which attempted to prove otherwise are without technical basis.

II.8.2 Degree of Reliance on Possible Scientific Breakthroughs and Significance of Ongoing Research

After the periods of time for which there should be reasonable assurance of waste isolation and containment, perhaps the next most misunderstood aspect of radioactive waste disposal is the degree of any reliance on

possible scientific breakthroughs and the significance of ongoing research. Several Participants have asserted that, based on the status of technology today, a finding of confidence in society's ability to dispose of nuclear wastes safely would be premature. Many of these Participants point to a perceived lack of an adequate scientific data base and "gaps" in scientific knowledge. NRDC PS at 18; NECNP PS at 15-26, 61-67, 107-122; SHL PS at 1-2; NY PS at 38-40, 77-101; CEC PS at i, 9-12. The thrust of their assertions is that, because the Department has identified areas where additional research and development are desirable, today's technology must be inadequate to support a finding of confidence. This point of view is simply wrong.

The Department's Statement of Position states that the Department does not attempt to prove that safe disposal of radioactive wastes, with the required approval of the appropriate regulatory authorities, can be achieved today. DOE PS at I-5. Rather, the Department shows that such disposal can be achieved within reasonable times (which are specified) upon completion of its current research and development and site exploration programs. The Department submits that substantial progress has been made in waste management in recent years and that the bulk of the required technical information already exists in the extensive body of knowledge that has been developed, as described throughout the Department's Position Statement, in the publicly available literature and in the already voluminous record of this proceeding. The other Participants had several months to examine the extensive publicly available references that are part of the record of this proceeding and over 2 months to study the Department's Statement of Position prior to the submission of their own Statements. None of the Position Statements filed in this proceeding have either identified substantive issues not discussed in the Department's Position Statement or seriously challenged the bases of the Department's Statements. Therefore, the Department maintains that its original position is still correct.

Any so-called "gaps" in the scientific data base that the Department has outlined in its Position Statement are not chasms that must be crossed to make geologic disposal feasible. They do not represent unknowns in basic physical laws or require scientific breakthroughs for their resolution. And, although filling of the "gaps" would allow a more precise (less conservative) approach to design and analyses, there is, as will be shown below,

firm technical basis for concluding that those "gaps" can be bridged today using bounding assumptions and the Department's conservative approach. See DOE PS at II-22 to II-26.

Specific technical issues raised by other Participants are discussed issue-by-issue in later sections of this Cross-Statement. Before turning to these specific issues, it is important to understand the relative significance of ongoing research and development efforts. As the American Nuclear Society notes in the Statement of Position it submitted in this proceeding, ". . . research for possibly improved systems should not be equated with, or construed as, the absence of a highly suitable existing technology." ANS PS at 8. The ANS goes on to observe, "Failure to understand this fact has led to much of the confusion that admittedly exists about the technical basis for safe and environmentally acceptable disposal." Id. The Department urges the Commission to assist in dispelling this confusion in this proceeding.

The NRDC asserts, ". . . confidence in the program must reflect an equal degree of confidence in each of its components." NRDC PS at 19. The Department disagrees. One of the attributes of the multibarrier approach being used by the Department for repository development is that the effectiveness of the total system does not rely on any single one of its parts. See, e.g., DOE PS at II-24 to II-25. The IRG supported this conclusion when it said:

Some uncertainties can be bounded or compensated for and, therefore, need not be resolved completely before selecting a site or constructing a repository. In addition, some will be resolved during repository construction. Although some residual uncertainty will always remain, reliance on conservative engineering practices and multiple barriers can compensate for a lack of total knowledge and predictive capability. DOE PS, Ref. II-2.

This above statement supports the Department's position that its technical programs are ". . . sufficiently diverse in scope that high assurance can be provided that acceptable systems will result without undue reliance on the results of any specific R&D effort," and ". . . sufficiently conservative to compensate for the residual uncertainties inherent in mined geologic disposal." DOE PS at II-298.

Some Participants suggest that, while DOE is performing R&D to fill certain gaps in available data, having an R&D program in place does not guarantee that favorable research results will occur on a basis timely enough to support the Department's schedule. NECNP PS at 29-31; Lewis PS at 3; ECNP PS at 4; NY PS at 39. The Department submits that the programs in place will be successful in reducing uncertainties, establishing the significance of system parameters and phenomena, and placing manageable bounds on any remaining "gaps." The times needed for such studies are accounted for in the Department's schedules. DOE PS at III-65 to III-68. In any case, these results will establish only the exact features of a mined geologic repository and are not required to establish the feasibility of the concept. Conservative design approaches already accommodate for uncertainties and provide the basis for confidence.

The California Department of Conservation attributes uncertainties to the ". . . immaturity of the disposal technology." CDC PS at 7. On the other hand, several other Participants agree with the Department's position that the current technology is adequate to support a finding of confidence. AIChE PS at 2; Bech PS at 5; ANS PS at 15-28; AIF PS at 9-20; UNWGMG-EEI, Doc. 2 at III-1 to III-G-8. The Statement of Ocean County and Township of Lower Alloway Creek says, for example, "Present projections indicate that technical solutions to the above research areas will become available in the near future." OC PS at 5. Neighbors for the Environment concludes ". . . a demonstrated technology exists in High-Level Nuclear Waste Management." NfE PS at 2; NfE PS, Rae at 2. This latter conclusion is based on a historical analysis by Professor Rae that compares three major technological innovations with nuclear waste management technology. Professor Rae states, "The demonstration of the technology is the point at which it can be determined that the extension of the technology or application of the technology will perform the desired function." NfE PS, Rae at 1. He also notes, "With respect to High Level Nuclear Waste Management: The methods have been thoroughly studied . . . and substantial experience has been acquired Based on this evidence I conclude that a demonstrated technology exists in High-Level Nuclear Waste Management." NfE PS, Rae at 1-2. He cites several papers to conclude that his definition of a demonstrated technology has been met in the case of nuclear waste management. Id. at 22.

Several NRDC assertions in this subject area appear to have been written without regard to the content of the Department's Position Statement and the enormous data base that is part of the record in this proceeding. For example, NRDC states, "Nor does DOE have a program which is reasonably designed to resolve the outstanding safety questions" NRDC PS at 18. Later NRDC says, "DOE has not identified and will not conduct the research and development effort necessary to produce a safe and reliable waste disposal program." Id. at 45. NRDC also charges, "The DOE program is highly likely to result in an inadequate and unsafe disposal system." Id. at 82. The Department's objectives for safe disposal are set forth and described in the Department's initial Statement. DOE PS at II-7 to II-21. Throughout the Statement, the Department reaffirms its commitment to meet regulatory standards when they are promulgated. See, e.g., DOE PS at II-4 to II-5, II-298 to II-299. Part II of the Department's Statement is replete with information concerning programs underway to resolve outstanding issues. See, e.g., DOE PS at II-139 and II-246. These are ignored by the NRDC.

Other examples of NRDC's erroneous assertions include this statement: "Site work has been restricted mostly to federal reservations in order to avoid public conflict." NRDC PS at 45. In Chapter II.D and Appendix B of the Department's Statement, there are lengthy discussions of a site characterization program that includes investigations in several States. Only two of the areas being investigated are on Federal reservations. Regional summary and recommendation reports have been prepared that identify salt domes in the Gulf Interior Region and bedded salt areas in the Paradox Basin and in the Salina Basin for further study. DOE PS at III-18. Detailed descriptions of these particular exploration programs were provided in Appendix B of the Department's Statement of Position. See DOE PS at B-3 to B-24, and B-42 to B-55. Plans are in progress to characterize other regions on non-Federal lands. NRDC also erroneously states that the Department already has selected salt as the geologic medium of choice for a repository. NRDC PS at 83. The Department schedule shows that six sites in four geologic media, including three other than salt, will be characterized before a site is selected. DOE PS, Figures III-2 and III-3. Contrary to these misrepresentations by NRDC, the Department has shown throughout its Position Statement that it has a program in place that will lead to safe and environmentally acceptable disposal

of high-level radioactive wastes in a time frame that is responsive to national needs.

Subsequent sections discuss in detail the specific technical issues raised by the other Participants in their respective Statements of Positions. Each of these other portions of this Cross-Statement demonstrates that the concerns expressed by some Participants in this proceeding do not detract in any substantial measure from the Department's demonstration of the technical basis for the safe and environmentally acceptable disposal of nuclear waste. UNWGMG-EEI also addresses many of these issues and discusses in detail the alleged "gaps" and uncertainties associated with them. See UNWGMG-EEI PS, Doc. 2 at III-1 to III-H-6. They conclude, "These subsystems, taken together as a total system provide confidence that the waste can be effectively contained by the system." UNWGMG-EEI PS, Doc. 2 at III-2.

In summary, the Department reiterates that the ongoing National Waste Terminal Storage (NWTS) Program will culminate in the development and licensing of safe and environmentally acceptable waste repositories on the schedule set forth in the Department's Statement without reliance on scientific breakthroughs. The Department submits that Participants whose Statements attempt to show otherwise have failed to do so, as their allegations have been shown to be based on erroneous assumptions or misunderstandings of the repository development process.

II.B.3 Technical Issues Related to Performance Assessment

Various Participants make statements about the methods used to assess the performance of mined geologic disposal systems. These include the general adequacy and use of computer models and specific contentions about (i) the leach rates and sorption assumptions used in these models and (ii) uncertainty in the understanding of radionuclide migration. Each of these points with appropriate references to the Department's initial Statement is discussed in the following sections.

II.B.3.1 Use of Computer Models in Performance Assessments

Assessments of the long-term performance of systems for mined geologic disposal are carried out with the use of mathematical descriptions, called models, of the phenomena that might affect the system. DOE PS at

II-198. A number of Participants, cited in the discussion that follows, have commented on various aspects of the use of these models. The most serious criticism they have made of the models is the assertion that the models are not yet adequately developed to allow a finding of confidence in geologic disposal. Because these Participants base this assertion on what they perceive as inadequacies in the models and in their use, this response begins by discussing those alleged inadequacies and then proceeds to discuss the principal criticism. The specific areas criticized as inadequate are model development and the collection of the input data that the models require.

Several Participants comment on the state of development of the models. Efforts to construct and validate models are described as in a formative stage. CEC PS at ii; NY PS at 51. The necessary models are alleged to be underdeveloped in that further development of thermomechanical models (especially for fractured media) is needed, along with a coupling of thermo-mechanical and hydrological models. CEC PS at 12-13 and 54; WN PS, Mudrey at 3. Models are said to be not yet ". . . comprehensive enough to simulate the hydrology of a complex system." CDC PS at 16. One Participant contends that the models ". . . will not be available for years. . . ." NY PS at 52.

The Department agrees that further development of models is necessary prior to final licensing decisions on permanent placement of wastes at a particular site. The Department's Position Statement at II-213 to II-223 discusses the continuing development of models and specifically mentions both models for fractured media and coupled models. DOE PS at II-219. Models capable of describing complex hydraulic systems are described in DOE PS at II-210 and in UNWGMG-EEI PS, Doc. 2 at III-G-4. Although development is continuing, the science of modeling is well advanced, as the California Department of Conservation observes. CDC PS at 16. Many models are now available as noted by the USGS, USGS PS at 15, and they are used routinely for assessing the long-term performance of repositories. DOE PS at II-213 to II-223; UNWGMG-EEI PS, Doc. 2 at III-G-2 to III-G-5 and Doc. 2 at App. III-6-1 to App. II-G-10.

The Department is also emphasizing in its program the verification of models using correlations with laboratory experiments, in situ tests, and observations of natural systems. DOE PS at II-202 to II-203 and II-242 to II-270. This verification process incorporates scientific peer review and

comparisons of various alternative techniques. The relationship of in situ testing to model development is further discussed in II.B.6.6 of this Cross-Statement.

The models require as input data quantitative descriptions of the phenomena that might affect a repository; they require data on the waste and its properties and on the geologic and hydrologic regimes in which a repository is built. DOE PS at II-203. Several Participants have commented on the need for such data. The USGS, for example, states that "considerable data" are still needed and that many of them can come only from site-specific investigations. USGS PS at 15. USGS suggests that data on bulk retardation properties of large volumes of rock are particularly important. Id. Other Participants also discuss the need for site-specific data and list general areas in which further data need to be obtained. NECNP PS at 20-26; CEC PS at 10. The California Energy Commission lists "knowledge gaps," i.e., areas in which more input data are needed for analyzing the possible movement of radio-nuclides from a repository. CEC PS at 50-55.

The Department's Position Statement describes the status of knowledge about the natural and man-made systems of mined geologic disposal in Chapters II.D and II.E. That description illustrates the wide extent of the data available for input into mathematical models. The Department agrees, however, that further data will need to be taken and is presently conducting a program to do so. Chapters II.D, II.E, and II.F of the Department's Position Statement contain discussions of extensive field, laboratory, and in situ studies now under way. These studies already cover the areas listed by the Participants cited above. Site-specific data are necessary for the detailed performance assessment of a particular site. The Department's Position Statement discusses the necessary data, DOE PS at II-70 to II-80, and presents plans for acquiring them. DOE PS at III-18 to III-23. The current incompleteness of the body of site-specific data, as another Participant observed, however, ". . . does not constitute 'gaps' in our scientific or technological knowledge. No scientific or technologic 'breakthrough' is required" UNWGMG-EEI PS, Doc. 2 at VI-2. See Section II.B.2, supra.

Because the models have not yet been completely developed and because further data are needed to describe all the phenomena completely, several Participants draw an erroneous conclusion, i.e., that the predictions of

the models allegedly are not adequate for establishing confidence in geologic disposal. The NRDC, citing a particular lack of data on ground water transport and nuclide sorption, concludes that ". . . there is no basis whatsoever . . ." for such confidence. NRDC PS at 60-64. The NECNP reasons, "The flaws in the data . . . raise serious questions concerning the validity of DOE's use of these models," NECNP FS at 19, and that ". . . data are lacking to such an extent that confident predictions cannot be made." Id. at 25. The NECNP suggests that because techniques for obtaining some hydrological data purportedly are undeveloped, ". . . there can be no confidence." NECNP PS at 28. Another Participant states that because of a lack of "essential data" the Department's risk assessments based on models ". . . cannot justify confidence in predictions for 10,000 years" NY PS at 50.

These Participants all fail to realize that establishing confidence does not require that all details of every physical and chemical process be modeled. When there are uncertainties about such details, the modeling can still provide adequate assessments or performance by using the limits of those uncertainties to produce conservative analyses. UNWGMG-EEI, Doc. 3 at 2-19, 2-20; and DOE PS at II-206 and II-207. The models have been used in this way--with conservative, bounding assumptions--to determine the limits to the adverse effects that the processes can produce. For example, when the sorption properties of the rock around a repository are not well known, NRDC PS at 62, the input data for a model of radionuclide migration can assume values that would underestimate the sorption. See II.B.3.2., infra. Uncertainty in the complex details of the near-field interactions between waste and ground water, DOE PS at II-220, can be adequately compensated for by using conservative inputs to analyses that predict the far-field performance of a system. DOE PS at II-223. In other words, this conservative approach uses parameter values that tend to give pessimistic results. UNWGMG-EEI PS, Doc. 3 at 3-49. It is such conservative studies that provide confidence in the long-term performance of geologic disposal systems, because they have shown that even pessimistic assumptions do not predict unacceptable performance of mined geologic disposal systems. The Department's Position Statement discusses this approach in several places. See, e.g., DOE PS at II-223 and II-234. Summary statements appear in DOE PS at II-242 and II-304. See also II.B.1., supra.

One Participant states that the Department places undue reliance on risk assessment, which requires estimates of the probabilities of the occurrence of natural geologic events and engineering failure. NRDC PS at 60. The Department agrees that probabilities of events that take place in the distant future are difficult to estimate accurately. The probabilities are especially uncertain for the low-probability events that have occurred in the region around a repository site only a few times in geologic history. DOE PS at II-209. The practice adopted in the Department's performance analyses, therefore, has been to rely heavily on predicting the consequences of phenomena rather than their risks. DOE PS at II-210. Accurate estimates of probability are not necessary when conservative, pessimistic assumptions about disruptive phenomena predict that the performance of a repository will be acceptable even if those phenomena occur. Estimates of risk are useful in deciding what disruptive phenomena need to be modeled, but the conservative approach adopted by the Department eliminates from study only phenomena that are clearly of extremely low probability--for example, the meteorite strike mentioned in the Department's Statement. DOE PS at II-225.

In addition to these broad comments on models, Participants also mention technical details of two examples given in the Department's Statement. One Participant criticizes an example of hydrologic-transport modeling because a " cursory examination " of one of the figures; DOE PS, Fig. II-26; "clearly discloses" that the results do not verify the model within the limits of its assumptions. The plume to the southwest is claimed by one Participant to be interpretable as a hydrologically significant fracture system. WN PS, Mudrey at 9. The California Department of Conservation ascribes this discrepancy in the modeling to inaccuracy in the input data. CDC PS at 16.

To decide whether or not a model fails requires more investigation than a " cursory examination " of a single figure. A technical evaluation of the modeling study requires reference to the original paper; DOE PS, Ref. II-699; which discusses the results in greater detail than the summary in the Department's Statement. The results for Sr^{90} shown in the example were dependent on the amount of data and the locations at which they were collected. Part of the discrepancy is due to the grid spacing for the model, and part is due to the value of the distribution coefficient, K_d , applied uniformly throughout the area. The original paper shows that the interpretation

of a fracture is not supported by the movement of any other nuclides (as illustrated in DOE PS, Fig. II-26).

The second of the detailed criticisms concerns the Department's estimate for the probability of an impact by a giant meteorite, DOE PS at II-225, which is said to be incorrect. WN PS, Mudrey at 7. The probability during 1 trillion years is said to be much greater than 1 on the basis of lunar impact research and of looking at the surface of the Moon and other bodies. Id. The meteorite-impact probability cannot be greater than 1; probabilities by definition are no greater than 1. The Participant seems not to realize that the quoted value is based on studies of meteorite impacts on the Earth and the Moon. Participants who wish to make detailed technical criticisms are referred to the original paper. DOE PS, Ref. II-659.

In summary, the areas cited by the Participants as requiring further research have not been overlooked by the NWTS Program. As described in the above references to the Department's Statement of Position, these programs are currently refining and coupling models and extending the data used with them. The Participants' principal objections to the models rest on their incorrect statements that no predictions can give confidence in mined geologic disposal unless all details have been accounted for. The Department's studies use models with conservative assumptions and input data that bound the effects of the processes that are not yet completely understood, and which, therefore, conservatively predict performance.

II.B.3.2 Leach Rates and Sorption

Radionuclide transport by fluids has been recognized as the principal naturally occurring phenomenon that could result in removing radionuclides from a repository. DOE PS at II-76. The rates at which these fluids might leach radionuclides from spent fuel are important in assessing the performance of a mined geologic repository. If these fluids subsequently carry radionuclides through the geologic media near the repository, the rate at which the radionuclides would migrate depends on the ability of the media to sorb, or hold them, thus slowing their movement. Leach rates and sorption properties are therefore important input data for models used in studying long-term repository performance. The discussion in this section, therefore,

is closely related to II.B.3.1, supra, which discusses Participants' statements on modeling and the following section on radionuclide migration rates.

The California Energy Commission asserts that the current levels of understanding of leach and sorption rates represent ". . . information gaps which prevent a complete understanding of the processes governing the migration of nuclides from a repository." CEC PS at 50. This Participant, citing a report on the leaching of glass and ceramics, lists specific deficiencies. CEC PS at 51 to 52. Its Statement also mentions data needed on sorption processes. CEC PS at 55. The California Energy Commission's discussion of leaching is based on two reports from 1977 that are themselves based on yet earlier work. More knowledge and understanding have been gained since then, as shown, for example, by a number of references cited in the Department's Statement. DOE PS, Ref. II-309 through II-330. The California Energy Commission's Statement does not recognize the existence of this work. The Department does not contend, however, that there are no uncertainties in the knowledge of leach rates. Under the NWTS Program, experiments are continuing to refine this knowledge. DOE PS at II-140.

The NRDC criticizes the state of knowledge of the sorption of radionuclides by rocks; its Statement draws on a 1978 study of the data collected up to that time and on a 1979 study that criticizes the time span over which the sorption measurements had been made. Like leaching, the sorption of radionuclides is not completely understood, and for that reason the NWTS Program includes experimental studies of sorption. DOE PS at II-74 and II-99. The data available now, however, are adequate for bounding assessments, as explained below. The characteristics of proposed repository sites will require the measurement of site-specific sorption parameters; two studies that have, for example, already used site-specific sorption data are referenced in the DOE Statement. DOE PS, Refs. II-669 and II-670.

Two Participants draw attention to the treatment of sorption processes used in modeling. The use of the distribution coefficient, called K_d , is questioned because it is not thermodynamically defined; it is suggested that its use does not ". . . permit an accurate understanding of solute/solvent interactions." WN PS, Mudrey at 6. The competition of migrating particles for the available sorption sites on rocks is cited as a process that is missing from current models of sorption. CEC PS at 55.

As pointed out in the Department's Statement, the quantity called K_d is indeed an empirical quantity that does not express the details of the mechanisms by which sorption occurs. DOE PS at II-212. It is useful for calculations that estimate the times required for radionuclides to traverse long flow paths and for calculations that bound the effects of sorption. Detailed understanding of all the mechanisms that contribute to radionuclide sorption are not necessary for such calculations, which simply require empirical data of the kind represented by K_d measurements. As stated by one Participant, "Adequate models can be developed on a phenomenological basis." UNWGM-EEI PS, Doc. 3 at 2-26. The Department agrees that better understanding of the detailed mechanisms of sorption are desirable because such would make it possible to carry out performance analyzes with less conservative, less pessimistic assumptions. To gain this better understanding, the NWTs Program includes the further studies cited above. DOE PS, Ref. II-568.

NRDC and the California Energy Commission conclude that the remaining uncertainties in the Department's knowledge of leaching and sorption are so great that they contribute to a lack of confidence in mined geologic disposal. NRDC PS at 64; CEC PS at i. These Participants fail to realize that establishing confidence does not require that all details of leaching and sorption be completely understood. As explained in more detail in II.B.3.1 of this Cross-Statement, the predictions of repository performance can be made under conservative, bounding assumptions about the effects of phenomena that, like leaching and sorption, are not completely understood.

In summary, the criticisms offered about present uncertainties in the descriptions of leaching and sorption fail to acknowledge the present body of knowledge, which has been used with conservative and bounding calculations to show that acceptable performance of mined geologic disposal systems can be achieved.

II.B.3.3 Radionuclide Migration Rates

An understanding of the rates at which radionuclides might migrate from a repository toward the biosphere is necessary for assessing whether or not a repository will achieve the isolation and containment required of it. Predictions of migration are made with models that rely on

detailed sorption and leaching mechanisms; for this reason, the reader is referred to Sections II.B.3.1 and II.B.3.2 of this Cross-Statement, which contain discussions that supplement the material in this section.

One Participant notes ". . . large uncertainties concerning the speed and modes of migration of radionuclides." NY PS at 83. Measurements of the physical and chemical processes that control transport over long flow paths are said to be still in the future. Id. Another Participant lists a number of ". . . information gaps which prevent a complete understanding of the processes governing the migration" CEC PS at 50-55.

That some uncertainties remain in the predictions of radionuclide migration is not at issue; Chapters II.D. and II.F of the Department's Position Statement discuss the experimental measurements and the development of models that are contributing to the resolution of these uncertainties. The Participants fail to realize that establishing confidence does not require that all details of radionuclide migration be completely understood. As explained in more detail in Section II.B.3.1 of the Cross-Statement, the predictions of repository performance can be made under conservative, bounding assumptions about the effects of radionuclide migration. Such predictions have contributed to the Department's position in this proceeding. DOE PS at II-223, II-234, II-242, and II-304.

One Participant implies that the DOE programs are designed to meet objectives (for controlling radionuclide releases) that are not the same as the criteria recently circulated in draft form by the NRC. In particular, this Participant, citing a draft criterion for containment, finds ". . . no evidence that the DOE programs can or will meet this criteria (sic)." NRDC PS at 32. The Department's Position Statement points out that the plans for the NWTs Program are using information from proposed NRC regulations; the objectives of that program are intentionally framed in broad terms so that the R&D provides the required information to meet applicable regulatory requirements. DOE PS at II-5. As discussed in Section II.A.7 of this Cross-Statement, it is inappropriate to utilize the NRC staff's "strawman" criteria as a basis for judging the Department's position in this rulemaking proceeding. However, as is also discussed in II.B.1 of this Cross-Statement, the Department contends that its intention to provide containment within the waste

package during the time in which radioactivity is dominated by fission product decay is supported by the NRC Staff position. This position is further supported by other Participants. UNWGMG-EEI PS, Doc. 2 at I-5 to I-9; USGS PS at 10.

One Participant concludes, "Nature . . . has already supplied confirmatory evidence of the defense in depth provided by multiple naturally occurring barriers." ANS PS at 24. This reference is to the retention of many fission-product species and most transuranic elements produced by the natural reactor that formed at Oklo, a uranium mine in Gabon, West Africa, about 2 billion years ago. The accumulation that forms any ore body is evidence that geochemical conditions were favorable for a concentration of the elements substantially greater than their average abundance in the Earth's crust and for their subsequent movement to the site of deposition. After deposition, the continued existence of the ore body (after the Oklo reactor finally shut off) means that no mechanisms or processes to which the body was exposed were able to reverse the deposition. Similarly, Oklo or any existing uranium deposit illustrates that there are circumstances under which certain nuclides are essentially immobile for long periods of time.

Oklo is not in itself confirmatory evidence of the argument for defense in depth provided by naturally occurring barriers. Rather, Oklo supplies a collection of clues on how to use various chemical processes to immobilize waste and what problems to avoid in order to ensure that immobility. The Oklo phenomenon suggests a means of waste immobilization, DOE PS at II-140, and the importance of characterizing the geochemistry of a site. DOE PS at II-269.

In summary, any uncertainties in the understanding of radionuclide migration are already being addressed by the NWTs Program. The principal criticism based on the existence of those uncertainties is the incorrect assumption that no predictions can give confidence in mined geologic disposal unless all details of radionuclide migration have been accounted for. The Department of Energy studies, using parameters that bound the effects of radionuclide migration, indicate that adequate modeling of the performance of mined geologic disposal can be achieved. See Section II.B.3.1.

Several Participants have raised issues about dose rates and their possible health effects in the contexts of three variables: (i) time period, operational or post closure; (ii) exposure group, public or occupational; and (iii) exposure condition, routine or accident.

The State of New York expresses concern over the Department of Energy Position Statement's degree of coverage of occupational exposures and the adequacy of present occupational radiation protection standards. NY PS at 32. While considerations of length did not permit extended discussion of this matter in the Department's Statement, occupational exposures, under both normal and accident conditions, are discussed in detail in conceptual design reports referenced in the Statement. DOE PS, Ref. II-772 and II-773.

The State of New York's Statement implies that NRC and EPA plans to hold hearings on occupational radiation exposure standards is an indication of the inadequacy of present occupational standards. NY PS at 32. Even though this question is beyond the scope of this proceeding, examinations of the Department's Policy Statement, DOE PS at II-274 to II-279, and the referenced conceptual design reports will indicate that reasonable reductions in present standards would not seriously affect repository design and operation.

Concerns over public exposures raised in this proceeding are very general in nature. Safe Haven, Ltd., states, for example, "People fear the carcinogenic, mutagenic and somatic effects of wastes' radioactivity on themselves, their children, their grandchildren and many generations to come." SHL PS at 3. The Ocean County and Township of Lower Alloway Creek Statement suggests, "A realistic, independent study must be made to examine the effects of nuclear energy over an extended period of time." OC PS at 19. The National Resources Defense Council states that a set of criteria is needed, ". . . the over-riding objective of which is the protection of present and future generations from the ionizing radiation associated with the wastes." NRDC PS at 82. Probably no words in this Cross-Statement will allay these Participants' apprehension about radiation; however, the data upon which an assessment of the magnitude of doses can be based are given in the previously referenced conceptual design reports. DOE PS, Ref. II-772 and II-773. These documents relate dose rates and dose commitments to both the public and workers, from both routine and accidental releases. These data, coupled with a

methodology for extrapolating doses to health effects, which is given in the 1980 BEIR III Report (41), enable one to calculate the number of health effects that can be predicted to occur as a result of any radiological exposure. The results of such calculations for the operational and post-closure impacts of a high-level nuclear waste repository, viewed in perspective with other risks with which people are, perhaps, more familiar, are discussed in Section II.B.1 of this Cross-Statement.

The State of Delaware suggests, "A Federal health agency must monitor exposure effects on a long-term basis, including the genetic and semantic (sic) effects of radiation on several generations." DOE PS at 6. The Department has cooperated in providing information to such studies. Two examples of such cooperation involved studies sponsored by the National Academy of Science (42) and the Department of Health Education and Welfare (43).

Participant Lewis dramatically postulates that "An extensive high level waste accident can loose thousands of pounds of plutonium into the air, ground and water. A few pounds of properly delivered plutonium can kill every man, woman and child on this Earth." Lewis PS at 7. The suggestion that solidified wastes entombed nearly 1/2 mile beneath the surface of the earth can somehow be distributed to the world population in the manner described by Mr. Lewis is a ludicrous exercise in numerology. Mr. Lewis completely ignores the fact that there is no mechanism to distribute wastes as he describes, even locally. To suggest that it could happen on a global basis is totally without basis in fact. The accidents that have been analyzed employing "worst-case" assumptions do not remotely approach the consequences stated by Mr. Lewis.

Participant Lochstet in his Position Statement takes exception to the Department's Statement, DOE PS at II-9, that ". . . long-term radiological consequences to the public due to effects of any reasonably foreseeable events or processes are predicted to be within the range of variations experienced with background radiation." Lochstet PS at 2. Projecting the dose rate described in the Department's Statement (1 to 20 mrem/yr) to health effects if the world population were at risk, Dr. Lochstet predicts an unacceptably high 100-year risk commitment from postulated releases of long-lived nuclides such as I-129 and Rn-222. Lochstet PS at 2-4. Although the methodology outlined in the 1972 BEIR Report (44) is followed, Dr. Lochstet apparently does not recognize that such calculations are applicable only within

the limited region potentially impacted by a repository. Regardless of whether the exposure mechanism is direct exposure, atmospheric transport, or aquatic transport, the area impacted would be relatively small, since doses delivered by any of the three mechanisms decrease rapidly with distance from a repository. The application of a population-related criterion; DOE PS, Ref. II-18; along with exclusion and control zones around the repository, will serve to minimize the affected population. Dr. Lochstet's analysis of impact on the world-wide population cannot occur using credible transport assumptions and is therefore invalid. Projection of impact over a 100-year period appears to have been used only to magnify the apparent effect. The 100-year time frame has no significance in a valid health effect assessment. Standard procedure is to calculate a 50-year dose commitment. DOE PS, Ref. II-589 to II-591. These conclusions are reaffirmed in the Atomic Industrial Forum's Position Statement, which concludes that a realistic risk assessment yields a potential of 74 fatalities over 13 million years; i.e., about one fatality every 200,000 years. AIF PS at 22. See also II.B.1 of this Cross-Statement for a discussion of related concerns expressed by Dr. Lochstet.

In summary, an analysis of the data presented by other Participants, as discussed above, substantiates the Department's position that (i) "The (long-term) analyses performed to date give no indication that a mined geologic disposal system, designed and constructed according to the requirements described in this Statement, cannot isolate radioactive waste safely," DOE PS II-242, and (ii) "Based on the evaluations available to date, operational-phase activities do not appear to be a limiting factor for an acceptable repository." DOE PS II-285.

II.B.4 Technical Issues Related to the Waste Package

Various Participants make statements about the development and adequacy of the waste package for mined geologic disposal. These include comments on (i) the interaction of waste with the host rock, (ii) the adequacy of spent fuel as the waste form, and (iii) the technology to develop an acceptable multibarrier waste package. Each of these points with appropriate references to the Department's initial Statement is discussed in the following sections.

II.B.4.1 Waste/Rock Interaction

A Participant states, "The properties of potential host rocks and their interactions with radioactive wastes are not understood." NY PS at 78. Other Participants make the same point by referring to uncertainties about hot waste reacting with host rocks and other uncertainties in waste/rock interactions. CDC PS at 9; CEC PS at 10. While uncertainty is inherent in all technical endeavors (see II.B.2), this contention is not consistent with the significant amount of information developed by the Department's R&D programs. The effects of heat on the rock mass in the vicinity of the waste package, in the repository rooms, and in the region surrounding, have always been recognized as phenomena to be understood. The models and supporting data for evaluating the impact of these effects are presented in the Department's Statement. DOE PS at II-166 to II-176. Specific points relating to thermal effects are summarized in Section II.B.5.1 of this Cross-Statement.

Further evidence of undue emphasis on uncertainty in areas where significant knowledge is available is the State of New York's contention that "Much of what is known about radiation effects . . . is disturbing." NY PS at 81. This assertion about waste/rock interaction is in total contrast to the evidence provided by analyses and experimental data in the Department's Statement, i.e., (i) any influence on strength is limited to within 1 meter of the waste and does not influence room or regional scale rock response; DOE PS at II-176; (ii) no serious consequences can be identified from stored energy in the rock; DOE PS at II-177; (iii) radiolytic effects on brine chemistry are incorporated into experimental programs, which have identified several potential alloys meeting the Department's containment objective; DOE PS at II-144; and (iv) gas production from radiolysis is extremely small and insignificant compared to other studies of gas production and associated repository response. DOE PS, Ref. II-372.

Furthermore, impacts of heat and radiation that affect interaction between the ground water and the waste package can be further mitigated by waste package design, including retardation of intruding fluids, alteration of fluid chemistry, and radiation shielding. DOE PS at II-132 to II-137. Likewise, the repository design can limit maximum temperatures and hence reduce temperature effects on various reactions by lowering canister power

levels or areal thermal power densities. DOE PS II-170 to II-171. The reference temperatures provided in the Department's Statement for various host rocks are well below the temperatures used in many waste interaction studies. DOE PS at II-58 to II-68. The use of these mitigating techniques is also recognized by other Participants who are familiar with engineering design principles. UNWGMG-EE1, Doc. 2 at III.B.15-17 and Doc. 3 at 3-18-28.

It is further contended that several years of specific research on spent fuel interactions are needed. NY PS at 82. In addition, it is questioned whether tests can be completed in time to locate a repository. CDC PS at 22. The principal difference between spent fuel and other HLW forms which already may have been studied in greater detail can be categorized as (i) those effects experienced by the host rock external to the waste package, i.e., heat and radiation, and (ii) those effects involving direct interactions between the geologic environment and the waste form itself or its radionuclide inventory. The penetrating radiation output per assembly for spent fuel is lower than that of more concentrated HLW forms; and the thermal power, while less per unit assembly, has different temporal characteristics. The external effects are specifically addressed in the assessments presented in the Department's Statement and do not present unusual difficulty. DOE PS II-55 to II-68 and II-167 to II-169. The requirement for additional research and testing on spent fuel direct interactions is recognized. The research in progress is discussed in the Department's Statement, DOE PS II-139 to II-141, and restated in the next section. The Department's schedule allows time for intergration of results into waste package designs.

If, after some period of time, the package is breached and some radionuclides are mobilized, the host rock and surrounding rock strata provide an additional barrier to radionuclide migration through beneficial waste/rock interactions, i.e., retardation via sorption. Although there are some uncertainties in retardation factors, the bounds on these uncertainties (see II.B.2) are considered in performance assessments at specific sites. The Department has provided examples of the application of conservative values for retardation coefficients that demonstrate that it is possible to effectively isolate radionuclides. See II.B.3.2. This conclusion is supported by other documents of record in this proceeding. USGS PS at 11-12.

In summary, contentions that little is known about the interaction of radioactive wastes and host rocks and that extensive research is needed before confidence can be established cannot be supported in view of the body of information developed by the Department on thermal and radiation effects and waste package interactions. Moreover, they do not consider the different alternatives in waste package and repository design that can be employed to achieve a conservative system. Finally, they fail to recognize that the effects of many individual processes can be bounded in assessments of system performance for specific sites.

II.B.4.2 Waste Form

Two Participants contend that lack of an "established" waste form does not allow quantification of the performance of the waste form and, hence, engineering decisions about leaching under repository conditions. CDC PS at 8; WN PS, Mudrey at 5. Further, NRDC contends, "The DOE program will not lead to an adequate waste form." NRDC PS at 46. The Department does not agree with these contentions. While the Department has not specified the final configuration of the spent fuel in the waste package, the basic form of spent fuel (UO_2 pellets) is unlikely to be changed as encapsulants or stabilizers are specified. This characterization is adequate to develop its degradation characteristics in geologic environments. The procedure for incorporating results from research on spent fuels pellets and cladding into a reference design for a repository is documented. DOE PS, Ref. II-306. NRDC's contention is based on an assumption that is inconsistent with the Department's stated position in the proceedings; i.e., the NRDC states, "Glass continues to be the Department's 'reference waste form.'" NRDC PS at 46. This assertion reflects the Participant's unawareness with the Department's program and position and is counter to the scope of this proceeding.

Issues of the complexity of spent fuel as a material and uncertainties about its stability as a barrier have been raised by three of the Participants. USGS PS at 12; NY PS at 83; NECNP PS at 107-113. One Participant pointed to a "gap" with regard to leach rates. CEC PS at 10. The complexity of spent fuel is recognized by the Department, and a number of programs are in progress to define more completely its behavior as a package

component under expected repository conditions. DOE PS, Ref. II-307 to II-313. Moreover, these complexities can be accommodated in the waste package design. The implications of great uncertainty are inconsistent with recent experimental results. These data include considerable information on the leaching of spent fuel over a range of temperatures, radiation doses, and leachant compositions. DOE PS at II-140 and II-141. Sufficient data are available to bound the degradation characteristics of spent fuel in performance assessments and to provide confidence that spent fuel can be handled as a waste form. Nevertheless, research on numerous effects, including degree of oxidation and chemical distribution on nuclide release, diffusion release rates, and hydrothermal conditions up to 300°C, is continuing as part of the waste package program.

NECNP cites uncertainty in the corrosion resistance of the fuel cladding as another major area of concern or uncertainty. NECNP PS at 108. In the examples of repository performance assessment cited by the Department, no credit was taken for the presence of cladding material; i.e., no reliance on cladding integrity is assumed. DOE PS at II-151, II-226, II-232. Yet these examples support the contention that adequately low radionuclide release can be achieved. To the extent that the cladding does resist corrosion, however, it is functioning as a redundant barrier to the influx of water to the waste form.

Two of the Participants raised the question of possible release of gas from the spent fuel. NY PS at 83 and NECNP PS at 108-109. This is recognized by the Department and is one of the reasons that venting the spent fuel prior to emplacement in the repository may be employed. DOE PS at II-140. However, with the spent fuel encapsulated as a part of the package system, potential release of gas from the waste does not necessarily imply gas release from the package both during the operational phase and the period of containment.

In summary, allegations that the waste form must be specified and that spent fuel is too complex to allow performance assessments and engineering decisions are not valid. The Department submits that its program will lead to an adequate waste form. The data now available on the behavior of spent fuel as well as that for other package components provide confidence

that spent fuel can be satisfactorily packaged. This conclusion is also shared by others in this proceeding. SE2-CN PS at 6, UNWMMG-EEI PS, Doc. 2 at III-B-18.

II.B.4.3 Engineered Barriers

Four Participants have indicated that there are insufficient data to have confidence that a long-lived multibarrier package can be provided. NRDC PS at 18 and 32; NECNP PS at 18; IL PS at 3 and 4; and CEC PS at 50-53. The Department's Statement describes the work pertaining to a long-lived multibarrier package in some detail, with numerous references to the technical literature. DOE PS at II-129 to II-152. This work includes efforts on the waste form, materials for stabilizers for those package concepts that call for them; canister, overpack, and sleeve materials of metals and ceramics, and candidate materials for hole backfill applications. Further development of package materials and components, package design, testing, and performance assessment has been described in the Waste Package Program. DOE PS, Ref. II-306. The Department has provided evidence to support its position that long-lived multibarrier packages can be designed and built in a timely manner. DOE PS at II-137 to II-152. This position is supported by others in this proceeding, such as the USGS, which states, ". . . the principle of a long-lived canister has merit, and is within the capability of materials science technology to achieve in the same time frame as repository site identification, qualification and development." USGS PS at 11. The work in other countries, particularly Sweden, further supports the Department's position. The Swedish work was reviewed by the National Research Council, which concluded that the effectiveness of the Swedish waste package ". . . to contain the radionuclides in spent fuel rods for hundreds of thousands of years has been amply demonstrated." DOE PS, Ref. II-380.

In discussing "encapsulation," the NECNP seems concerned that no canister or container for spent fuel will be used, even though all Department concepts and discussion of engineered barriers include a canister (and usually an overpack), which in fact amounts to double encapsulation. NECNP PS at 110-113. To support its concern about the potentially deleterious effects of having no canister, it draws upon the work of McCarthy (Nature 273, p. 216, (1978)) which addressed glass and calcine and hence is largely irrelevant to

discussions concerning the waste form assumed in this rulemaking. The cited work, for the most part, was done at temperatures well above those expected in a repository environment and did not purport to simulate a multiple barrier system.

Several Participants have raised questions regarding materials degradation, suggesting that: materials likely to survive have not been identified, CEC PS at 50; corrosion has only been defined, NRDC PS at 18; there are no hard data, NRDC PS at 32; barriers can last only decades or at most a few centuries, NY PS at 55; and because of lack of attention "Canisters are almost worthless for ensuring of long-term isolation." NY PS at 93. However, the Department has provided in its Position Statement a large body of data on the degradation of various package materials, particularly relating to corrosion of canister, overpack, and sleeve candidates. DOE PS at II-137 to II-152. Materials have been screened with a variety of water compositions, over a range of temperature and oxidizing conditions and in the presence of radiation covering the range of conditions expected in a repository. While it is true that final selection of component materials has not been made and work is continuing, promising candidates have been identified and tested for all components of the package.

Two of the participants have cited a lack of data on backfills in contending that package work is inadequate. CDC PS at 22; CEC PS at 54. Since the backfill material will be compatible with a given host rock and no site has been selected, it is impossible to say what, specifically, the backfill will be. Nonetheless, candidate backfill materials, discussed in the Department's Statement, have been and are continuing to be evaluated and there are data on candidate materials which indicate materials with significant radionuclide sorption capability are available and that their sorptive properties can be maintained at adequate levels at elevated temperature and in the presence of radiation. DOE PS at II-139 to II-152.

In summary, the Department submits that, in spite of contention: to the contrary, there is sufficient knowledge to be confident that geologic disposal with engineered barriers is technically feasible and can be safe. This conclusion is supported by other Participants in this proceeding. The SE2-CN Statement says there are adequate data. SE2-CN PS at 6. The Utility Nuclear Waste Management Group - Edison Electric Institute; UNWGMG-EEI PS,

Doc. 2 at III-B-18; states confidence that the waste form and package will perform as required, and at III-C-1 to III-C-5 that materials are available to assure overall performance. The UNWGMG-EEI Statement says that multiple barriers provide confidence waste can be contained. UNWGMG-EEI PS, Doc. 3 at 3-11. The ANS Position Statement states, "This defense-in-depth approach gives a high degree of assurance of success." ANS PS at 16.

II.B.5 Technical Issues Related to Repository Performance

Various Participants also make statements about specific issues related to the design, development, and operation of a repository. These include comments on (i) the impact of heat on the host rock, (ii) the sealing of penetrations into the repository, (iii) the capability for retrieval of the waste, (iv) decommissioning of the site, (v) operational and post-closure monitoring, and (vi) the potential for human intrusion. Each of these points with appropriate references to the Department's initial Statement is discussed in the following sections.

II.B.5.1 Thermal Effects

The influence of heat producing wastes on the characteristics of rocks has been addressed by several Participants. NY PS at 79-80, 85-87, 91; NRDC PS at 51-52; CEC PS at 12-13; CEC PS at 67. The Participants contend that the thermal effects on rock are not known and that the deformation and strength characteristics (and hence, the stability of rooms, pillars, and surrounding rocks) of the rocks will be drastically affected by temperature.

These contentions are inconsistent with the current level of understanding of these effects. Material characterization and modeling efforts, both completed and ongoing, have centered on the effects of temperature on the response of the host medium and on room and pillar stability. Specifically, constitutive models which include the stress-strain response as a function of temperature, load, load-rate, strain-rate, load-path and duration (DOE PS at II-217) have been developed and are available to predict the response of rock to stress and heat. DOE PS at II-27. Thus, analyses of room

and pillar stability and the surrounding rock in fact incorporate the influence of temperature upon the strength.

The contention of catastrophic consequences because of temperature appears to be a misinterpretation of the situation. NY PS at 80-91. As is recognized by other Participants, the thermal loads can be specified to assure adequate behavior of the repository. USGS PS at 14, CEC PS at 32; UNWGMG-EEI PS, Doc. III at 3-28. The Department agrees in principle that low temperatures are desirable. Typical temperatures are given in the Department's Position Statement for salt, granite, and basalt spent-fuel repositories. DOE PS at II-60, II-65, II-67. These are not design temperatures but the maximum temperatures for the rock (140°C for salt, 180°C for granite, and 250°C for basalt) and for the waste container (145°C in salt, 200°C in granite, and 280°C in basalt) which are currently considered to be sufficiently conservative. An appropriate choice of materials for the waste package can be made for temperatures in this range, and these rock temperatures are currently considered to be sufficiently low to limit waste/rock interactions to design levels. DOE PS at II-172 to II-176. As investigations proceed and more site specific data are obtained, conservative design criteria will be established using additional model predictions. These design criteria will be chosen to limit the impacts from heat. DOE PS at II-166.

Further, one Participant contends that, due to the strong dependence upon temperature, the mechanical behavior of salt will be drastically affected. NY PS at 86. The stages of the creep curve are described and conclusions drawn that a salt formation can "collapse overnight." The Participant further notes that increases in temperature lead to decreased strength and increased creep rates. NY PS at 87. Creep is a well-studied phenomenon in many materials and is routinely accommodated in engineering design. In addition, the conclusion about "collapse overnight" is a misconception of the conditions in the stages of creep and, further, the Participant erroneously correlates the stages of deformation observed in a laboratory experiment with large scale deformation of a geologic formation. The conclusion avoids the careful analysis of the time-dependent, thermally aided deformation of salt for the conditions of a repository (45, 46). DOE PS, Refs. II-446, II-451, II-716, II-717. A large number of models which predict these phenomena in

salt have been developed and have been tested against experimental observations (47). DOE PS, Ref. II-623; DOE PS at II-217. These specifically address the thermocreep and thermoplastic design analysis of room and pillar stability and predict the deformational response. The incorporation of these analyses into repository design ensures that the heat loads will not produce adverse effects in the host rock. DOE PS at II-215.

Two Participants express a similar concern about the potentially catastrophic effect of temperature on shale, granite, and tuff. NY PS at 91; NRDC PS at 42. These Participants appear to have assumed temperature increases beyond those intended for design of the repository. Results of the in situ thermal tests at Stripa demonstrate that below 300°C no significant deterioration of the granite occurs. DOE PS at II-260. In the use of shale, full-scale heaters (4 kW) which are about eight times the power level of a spent-fuel assembly have produced no evidence of decrepitation or degradation in Conasauga shale (48). DOE PS, Ref. II-757. Also, full-scale heater tests produced no compressive failures in Eleana shale; although contraction of the shale did occur in the near field to a distance into the shale of about 1 meter. DOE PS, Ref. II-754. In the case of tuff, phenomenological heater experiments, which were approximately equivalent to 2 kW heaters, were conducted with no observed decrepitation by maintaining the hole wall temperature below 200°C. DOE PS, Ref. B-60. Further, it should be pointed out that because the temperature profile is steep and the source temperature decreases with time, only a small, near-field volume of rock will be subjected to the highest temperatures; this further decreases possible adverse effects on the repository. The repository can be designed to keep maximum temperatures below specified limits.

One Participant expresses concern that the apparatus to achieve 200 bars and 500°C for testing do not exist, and that it may take years to build the apparatus. NRDC PS at 51-52. In view of the above discussion of upper limits of temperatures expected for design, the need for developing equipment capabilities for the higher temperatures seems poorly founded. Indeed, current apparatus are available and in use which have the capabilities of 200°C at confining pressures in excess of 200 bars. DOE PS, Ref. II-162.

The State of New York expresses concern about the effect of radiation upon the strength of salt. NY PS at 81. This concern was addressed

in the Department's Position Statement but has apparently been misunderstood. DOE PS at II-176 to II-179. See also II.B.4.1., supra. Attenuation of the radiation limits the influence of radiation damage to within 1 meter of the waste, and hence, its effects on the material very near the canister. Such near-field effects at the canister will not influence the overall repository behavior. Confirmatory tests of these conclusions are under way or planned for salt and other media. For example, the placement of spent fuel in the Climax test facility in Nevada has now been made and continuous observations of any resulting phenomena are ongoing. DOE PS at II-261 to II-263.

Two Participants question the availability and usefulness of thermomechanical models, contending that they are of limited use. NY PS at 79-80; CEC PS at 12-13, 67, and 73. The contentions are based on the assumption that all behavior, significant or not, must be modeled in order to obtain a satisfactory design. However, as indicated II.B.3.1 of this Cross-Statement, not all the parameters need to be precisely known to develop a design. The Department specifically recognizes this in that the models are used with conservative assumptions and varying values of parameters to predict the overall long-term repository performance. The variability and uncertainty in parameters are thus accounted for by conservative design. DOE PS II-222 to II-223. The California Energy Commission, CEC PS at 12-13, has interpreted the comments in one of its supporting references, CEC PS, Ref. 20, as a severe indictment of the adequacy of thermomechanical modeling. Its contention is, however, not supported by the concluding remarks of this same referenced document where the following statement is made:

The excavation itself would still perturb the natural state. However, we can hope so to design the repository system that re-equilibration can occur without loss of containment. In principle, we can fully characterize the initial state of the rock mass; model its response to thermomechanical loading; verify our predictions at least in the near fields; and design an excavation that will be stable for 50 to 100 years of retrievability, during which we would have plenty of time to correct mistakes and to reclaim a valuable source of energy should that option become national policy. CEC PS, Ref. 20 at 25.

Thus the conclusion of the referenced document is, in fact, an expression of a belief in the ability to successfully design a stable repository.

Further, this Participant, CEC PS at 13, has interpreted the comments quoted from another of its supporting references; CEC PS, Ref. 21 at 12; as saying coupled codes may never exist. This is clearly a misunderstanding since coupled codes are currently in existence. For example, the coupling of thermal and mechanical models into a single code is discussed in the Department's Statement. DOE PS at II-217 and II-219. Furthermore, codes which couple other phenomena are under development. DOE PS at II-241. It appears that Benson & Lichter, the authors of the cited reference, were speaking in a philosophical sense of attaining the perfectly coupled, global code, a code which is neither necessary nor prudent to attain a conservative design. See Section II.B.3.1 of this Cross-Statement.

The State of New York contends that heat will increase permeability in hard rocks or produce fractures in rocks overlying salt which will result in loss of capacity of the repository. NY PS at 80. This issue is specifically addressed in the Department's Statement of Position. DOE PS at II-75 to II-76. Using data from the hydrologic, thermal, mechanical, and chemical characterization of the host rock at a given site, suitable design measures for the system will be used to assure long-term isolation. Such a methodology has been set out in the Department's Statement. DOE PS at II-160 to II-188.

Apparent misinterpretations of scientific facts to support sweeping conclusions are presented by some Participants. For example, concerning the issue of fluid migration, this statement is made by NRDC:

. . . research has now uncovered significant problems with the geochemical and mechanical response to heat and water. These problems are sufficiently severe to eliminate salt as a potential candidate medium. NRDC PS at 48.

The basis given for this assertion is fluid migration in salt. A scenario is presented in which brine migrates to a heat source, increasing the rate of corrosion of the waste canister resulting in leaching of the waste. This is immediately followed by a stated high potential for radionuclide escape due to the low sorptive characteristics of salt. Further, it is

said the salt could be weakened and ". . . respond with increased creep rate, deformation, and possibly melting." NRDC PS at 48. The seriousness of this scenario is not supported by data from experimental results which are available to NRDC. DOE PS at II-173 to II-174. The phenomena described are not new revelations but have been under study by researchers since Project Salt Vault. Detailed calculations based upon scientific models supported by experiments show that, in a repository environment, the maximum quantity of fluid that might reach a canister would be about 6 liters over a 1,500-year period in contrast to the large quantities implied above. DOE PS at II-161. The Department's consideration of any possible impacts is supported by leach tests for waste forms and corrosion tests for canister materials conducted under conditions which simulate complete immersion in brine at temperature and oxidizing conditions more severe than expected for spent fuel in a repository. DOE PS at II-144 to II-145. Such tests have nevertheless identified several alloys capable of meeting the requirements of total containment of wastes during the period of time dominated by fission product decay.

Significant weakening of salt or enhanced creep rates due to brines have not been observed in the numerous heater experiments performed in either domed or bedded salt. Any process that might induce temperatures above the melting point of salt due to these phenomena simply has not been observed. Furthermore, if the reference to "melting" is actually a concern over creation of a multiphase system, the necessary conditions are outside the range of temperatures and brine contents that would be encountered by a spent fuel canister in any domed or bedded salt repository. Declaration of significant consequences without accurate consideration of the processes that could conceivably lead to such conditions also characterizes the statements of another Participant on the same subject, NY PS at 85, in which excerpts are drawn from documents describing potential research needs. NY PS, Ref. 5. The Department, despite extensive study and diligent examination of potential consequences has not been able to identify any serious consequence from brine migration. Any concern over impact on the waste package can easily be overcome by engineering design features. However, in situ tests to substantiate these conclusions will be continued and completed well prior to any licensing actions leading to permanent disposal of radioactive wastes. DOE PS at II-255 to II-257.

In conclusion, the points raised by other Participants about phenomena related to the effects of heat on the repository already have been addressed by the current Department program and shown not to be as serious as claimed. In all cases, the Department has shown that a significant body of information exists. Within the range of conditions that will occur in a properly designed repository, none of these phenomena have been shown to cause events or processes that would jeopardize the successful performance of repository functions.

II.B.5.2 Borehole and Shaft Sealing/Backfill

A few Participants contend that the technology for sealing of the boreholes, shafts, and drifts associated with a repository is a significant area in which the data and the current Department of Energy program are deficient. NRDC PS at 5, 18; NY PS at 98-99, NECNP PS at 18. One Participant also attempts to present a dilemma between the need for penetrations to characterize a site and the inability to develop and demonstrate sealing over the required isolation period. NRDC PS at 54.

Two suggestions are made: first, that nothing less than permanent, complete sealing is acceptable; CDC PS at 19; and second, that seals must provide a barrier to radionuclide migration at least equivalent to the host rock. NRDC PS at 55. This view is inconsistent with the role that penetration sealing plays in a systems assessment of repository performance. The Department's position is that penetration sealing must provide a barrier with sufficient integrity to ensure acceptable consequences. Hence only adequacy is desired, and it should be determined on a site-specific basis (49). This position is supported by those performance assessments that have predicted any significant release of radioactivity (50). DOE PS at II-224 to II-225; UNWGMG-EEI PS, Doc. 3 at A-1 to A-28. Most of these assessments assumed use of open conduits or conduits with hydraulic conductivities many orders of magnitude greater than the host rock.

Assuming this need for complete sealing, several Participants proceed to assert that the longevity of seals cannot be demonstrated and that experience with current technology is not applicable to repositories and does

not address long-term integrity. NY PS at 99; NRDC PS at 55; CDC PS at 21; NECNP PS at 18. These assertions ignore past experiences and tests now in progress that have shown seals to be effective. See DOE PS at II-182 to II-185; DOE PS Ref. II-518. The Department has long recognized the need for assessments of longevity and has incorporated this requirement into the program. DOE PS at II-184 to II-185. The strategies and programs implemented to address this subject have not revealed evidence of significant deterioration of plugs (51, 52). DOE PS Ref. II-519, II-521. Current field tests, DOE PS at II-185, are supplemented by companion laboratory studies using similar materials and host rocks to evaluate the geochemical stability under various environmental conditions. These include examination of materials emplaced in geologic formation several decades ago and evaluation of ancient cements from Roman architecture. DOE PS, Ref. II-519 to II-524. Furthermore, natural materials, such as salts and clays, which in nature may endure for geologic times, may be utilized to seal penetrations as site-specific conditions dictate.

Furthermore, these Participants contend that, while current research is in progress, there is no certainty that results will confirm the Department's projections. CDC at 20; NECNP PS at 19, 25. This contention fails to recognize (i) the Department's analysis of the role that penetration plays in a conservatively designed multiple-barrier system; (ii) the flexibility produced by the fact that the final choice of sealing material does not have to be made until after repository operations are concluded; NY PS at 77; and (iii) the confidence expressed by the National Academy of Sciences in its review of the Swedish proposals for sealing a repository in granite. ANS PS at 23. The relationship of current confidence and ongoing research is more fully addressed in Section II.B.2 of this Cross-Statement.

It is also stated that the emphasis in seal development has been on salt, "despite its many problems," to the detriment of hard rocks. NRDC PS at 56. The examples of "many problems" given (corrosion of shaft casings and materials) show the Participants' unfamiliarity with the Department's program in that shafts through salt horizons are not necessarily cased (53), DOE PS Ref. II-106, and the deformation characteristics of salt are ideally suited to self-healing of penetrations filled with salt or other natural materials. Furthermore, since many tests have concentrated on materials

for the harder rocks (e.g., anhydrite) associated with bedded salts, much of the technology is transferable to hard rock repositories. See DOE PS at II-185. Sealing programs have also been developed for the basalts at the Hanford site (54) and all of the seal development supporting underground nuclear weapons testing has been done for rocks other than salt, e.g. tuff and granite. DOE PS, Ref. II-518.

Additional concern is voiced about the impact of heat and radiation on penetration seals and room backfill. CDC PS at 20-22. The Department's Position Statement points out that the temperature increase in waste room backfill is very localized and that shaft and borehole seals will not experience significant temperature increases, since the seals will be located far from the heat source. DOE PS at II-187; DOE PS, Refs. II-107 and II-113. Likewise, the effects of radiation from spent fuel are limited to within a meter of host rock surrounding the canister and thus radiation has no significant effect on backfill or repository seals. DOE PS at II-176.

The Department does not view the use of boreholes to characterize a site as presenting a dilemma. Tests show that seals are effective; the adequacy of seal performance can be measured in the assessment of the overall repository performance; and, as previously discussed in the Department's Position Statement, DOE PS at II-181, boreholes can be prudently placed to minimize sealing requirements.

One Participant expresses a concern about the impact of temperature increases on emplacement hole backfill, specifically clay minerals, and questions the existence of sorption data for these clays. WN PS, Mudrey at 4. Similarly, the California Department of Conservation implies that no information specifying the best backfill material has been developed nor have the characteristics necessary to withstand the thermal stress been defined. CDC PS at 22. This contention is inconsistent with the orderly development of a waste package which is compatible with a repository design at a given site. Specifying the "best" backfill before more characteristic data are available is unsound. Rather, the Department is developing a number of "adequate" materials from which design choices can be made. The necessary characteristics to guide R&D studies have been identified in the Waste Package Program Plan DOE PS, Ref. II-306. Experimental programs to identify candidate materials which

have these characteristics are in progress. The Department, in its Position Statement, presented a summary of these data and tests under various temperature and fluid conditions. DOE PS at II-148 to II-149.

One Participant contends that locating existing boreholes has yet to be considered. NRDC at 56. This contention completely ignores the procedure specifically discussed by the Department in its initial statement which has been successfully employed at the Los Medanos site in southeastern New Mexico (50). DOE PS at II-181.

In summary, the suggestions about the inadequacy of technical data on sealing of repositories are based on improper assumptions that totally impervious seals are essential to the successful performance of a repository system. Such suggestions ignore the body of data available from current Department of Energy programs and completely discount the results that are being obtained from current research programs.

II.B.5.3 Retrieval

Several Participants suggest that the Department's Position Statement has not adequately addressed possible retrieval of waste from a repository. The State of New York asserts, "A methodology for assuring retrievability of the wastes has not been developed." NY PS at 96. New York also discusses potential hazards from retrieval to both the workers and the public. NY PS at 62n. The Department has described a general methodology for retrieval in its Position Statement. DOE PS at II-281 to II-283. The Department is committed to maintaining waste retrievability both to fulfill its own requirement to use a conservative stepwise approach; DOE PS at II-16, Objective 5; and to comply with whatever NRC and EPA regulations may eventually be established.

The Department is closely monitoring the NRC and EPA regulation development efforts, DOE PS at II-5, and is structuring its program to meet those agencies' regulations once they are adopted into law. DOE PS at II-282. Repository and waste package development efforts are consistent with the intent of the draft NRC retrievability requirements, i.e., maintaining the capability to safely retrieve wastes throughout the operational phase and for

an amount of time thereafter appropriate for the NRC to grant the necessary permission for decommissioning the repository. The issue of what constitutes an appropriate amount of time requires resolution, but does not present an obstacle to the conduct of the NWTS Program as described in the Department's Position Statement. See II.A.7, supra (concerning the use of draft criteria in this proceeding). A specific retrieval procedure will be developed prior to emplacing wastes when the detailed design of the engineering features of both the repository structure and waste package is complete. As noted in the Department's Statement, design features will be provided to allow for retrieval of emplaced canisters throughout the operating phase. DOE PS at II-281.

The nature of retrieval operations makes potential risks to the public extremely low. DOE PS at II-283, Item 5. For example, source terms would be limited by individual canister contents and there would be a low driving force for release of radioactive materials. It will be necessary to design the repository, waste package, handling equipment, and retrieval procedures to protect repository personnel from potential exposure to localized contamination and direct exposure. Such design provisions are within the state of the art, requiring technology and methods presently employed in providing in-plant radiation protection for existing nuclear facilities and those used by the Department to recover radioactive materials, including broken packages (55-57). DOE PS, Refs. II-772 and II-773. Efforts are ongoing to define the requirements for safe retrieval for subsequent implementation in repository design.

Two Participants quote an EPA report; NRDC PS, Ref. 25; which questioned the capability to retrieve because of canister corrosion. NRDC PS at 25, 31-32; MN PS, Abrahamson at 8. The Department discusses the currently applicable waste package requirements in its Position Statement and states, "The waste package must preserve the ability to retrieve the waste safely throughout the required repository demonstration period." DOE PS at II-135. In 1978, when the EPA report was prepared, the waste isolation concept on long-term radionuclide retention was based on the natural system. The canister was intended to contain the wastes during handling and emplacement only, and longlived canisters were not factored into conceptual design studies. The EPA report appropriately evaluated the predominant canister design at the

time. Results of the studies made more recently, which were not considered in the EPA studies, would have led to a different conclusion.

Two Participants address retrieval operations after repository closure. The New England Coalition on Nuclear Pollution states, "DOE should evaluate retrieval from a completely filled repository after a sufficient period of time that temperature and exact location would make retrieval and handling of the fuel a more uncertain operation." NECNP PS at 55. The California Department of Conservation states, ". . . the design of backfill material and penetration seals should allow for safe re-entry, maintaining the integrity of the repository." CDC PS at 22-23. Section II.F.3 of the Department's Position Statement considers the need for retrieval during and at the completion of the operational phase. Waste packages will be designed, at a minimum, to contain the wastes throughout the planned retrieval contingency period (approximately two times the planned duration of the operating phase) in order to facilitate retrieval and reduce operator risks. Once the NRC has authorized isolation and the repository has been sealed, retrieval will continue to be possible at an increased degree of difficulty, cost, and perhaps operator risk. It should be noted that such authorization by the NRC would be indicative of its confidence in the safety of the repository thereby making the need for subsequent retrieval, for safety reasons, highly unlikely. Waste packages will retain a high degree of integrity for a considerable period of time beyond repository closure. For example, the Department's proposed Performance Objective 1 would require containment throughout the period dominated by fission-product decay. DOE PS at II-7. See also II.B.1., supra. Therefore, although retrieval after isolation is not anticipated, the waste package and repository design features will allow retrieval after closure at a higher cost and degree of difficulty. It should be noted that if a decision were made to retrieve waste and to abandon the repository, long-term integrity of the host rock would be unimportant. See DOE PS at II-282.

Two participants contend that salt and shale are unacceptable media if retrievability is a design consideration. NRDC PS at 37; NY PS at 85 to 90 and 98. They base this contention on four considerations:

1. The corrosive effects of salt brine.

2. Possible movement of waste by brine migration.
3. Tendency for canisters to migrate downward in dry salt.
4. Room closure rates.

The first two effects can be avoided by proper design and selection of packaging materials, e.g., use of an absorbent to prevent the brine from contacting the canister. The Department's Statement of Position describes the brine migration phenomenon. DOE PS at II-58 to II-61. It notes that, for a typical emplacement configuration, ". . . the total accumulated influx of brine 1,500 years after emplacement is about 6 liters." DOE PS at II-59.

The waste package system is discussed in the Department's Position Statement. DOE PS at II-129 to II-160. This discussion notes that incursion of fluid is one of the principal phenomena of concern to waste package decision. DOE PS at II-131. It also states, "The waste package will consist of various components, each of which can mitigate the inputs of these phenomena on package performance." DOE PS at II-132.

Movement of waste packages in dry salt has been studied over a wide range of conditions. Although the migration of canisters in dry salt is theoretically possible, the rate of movement is extremely low and inconsequential relative to the ability to retrieve over the several decades when retrieval may be required. For example, one study has shown that the total movement over a period of 150 years would be less than 1 millimeter (58).

The room closure rates for salt and shale repositories could require "supports," as suggested by the State of New York, if it were decided to prevent the rooms from closing. NY PS at 98. On the other hand, the rooms may be backfilled and closed by design, and if retrieval were to become necessary, reopened using conventional mining techniques coupled with radiation protection measures. Either option is within the state of the art. The subject of creep is also discussed in II.B.5.1 of this Cross-Statement.

The State of Wisconsin has stated that the Department of Energy:

. . . should consider a "worst case" scenario. Reliance on a second repository would be impossible if the first repository would entail or suffer engineering problems prior to the second repository's

completion. Broad contingency plans need to be developed in order that an established procedure can be implemented to deal with potentially hazardous situations. WN PS, Leverance at 1.

The Department's Position Statement notes:

. . . waste removed from the repository could be transferred to temporary surface storage rather than to another repository. DOE PS at II-283.

Also, as previously noted,

. . . Retrieval probably will not be based on an immediate threat to the repository, but rather loss of confidence in long-term containment. DOE PS at II-282.

The Department is committed to following a careful step-wise approach in developing, designing, and operating waste disposal systems. Retrievability is a planned contingency provided in implementation of that approach. DOE PS at II-23. Detailed retrievability plans must, of necessity, be addressed on a site-specific, design-specific basis. However, the Department in its Position Statement, DOE PS at II-281, and in this Cross-Statement affirms its commitment to maintain waste retrievability throughout the operating phase. Both the material and technical requirements for a safe retrieval system can be provided using current technology. No Participant has raised a substantive retrievability issue precluding a finding of confidence in this proceeding.

II.B.5.4 Reclamation of Site/Decommissioning

The State of Wisconsin raises concerns regarding the reclamation of a repository site and particularly of surface disturbances. WN PS, Mudrey at 5. Dr. Mudrey questions the fate of a shaft sunk at a site which is later abandoned, and he also expresses concern about the disposition of rock tailings. Id. All sites investigated or utilized by the Department will be restored. This includes backfilling shafts, removing or stabilizing waste rock in a manner which meets applicable Department, EPA, NRC, and NEPA requirements, and restoring vegetative cover, as appropriate. See DOE PS at II-284 to II-285.

The Department is currently conducting an investigative program which includes the clearing of sites for the purpose of conducting drilling to obtain geologic cores. In all cases, the Department has published plans and environmental evaluations which state the intent to restore drilling sites to original condition (59). At several of these sites, such restoration has already been successfully accomplished. The Department intends that the same policy will apply to exploratory shafts and to any sites that are abandoned.

Regarding the disposition of rock tailings, a 1977 Department report discussing waste rock disposal considerations indicates that no matter what the geographical location of the waste rock generation activity or the geologic medium involved, there are multiple options for permanently disposing of the waste rock (60).

A discussion of the potential for leaching of the waste pile and subsequent environmental effects is given in the Department's Statement, DOE PS, Ref. II-532* at 3.1.120 to 3.1.123. This reference summarizes the impact assessment by saying that the leaching issue ". . . is more significant for salt repositories because of salt toxicity in biota and to a lesser extent for shale due to runoff of acids derived from pyrite in shale. The issue is probably of no consequence for granite or basalt." DOE PS, Ref. II-538 at 3.1.41.

II.B.5.5 Operational and Post-Closure Monitoring

A few Participants have expressed concern over present repository monitoring plans and capabilities as they relate to both the operational and post-closure time periods. The Department and most other Participants agree with NRDC's assertion that both health physics monitoring during the operational phase and monitoring for collection of data to determine whether the repository is capable of meeting the predetermined performance criteria are equally important. NRDC PS at 57. The questions raised in the Statements of other Participants can be summarized as follows: (i) Is the present Depart-

*This reference is one of the approximately 130 often-cited core documents that were placed in the Department's 10 regional offices and the Commission's Public Document Room for the use of the Participants in this proceeding.

ment of Energy monitoring planning effort in proportion to the problem? and (ii) Is it likely that the equipment to execute the necessary monitoring program will be available when needed?

NRDC contends that neither the nature of the monitoring nor the period of time it will be required have been determined. NRDC PS at 59. Regarding the required time period, the Department submits that the repository will be designed so as to make environmental monitoring after decommissioning unnecessary. DOE PS at II-285. However, the Department will establish appropriate programs to provide financial support to State or local agencies for any reasonable environmental monitoring deemed necessary to meet local concerns or to expand the data base. Beyond that, monitoring for R&D purposes and confirmatory monitoring of certain system features as may be required by NRC will be provided.

The amount of time that will pass before radionuclides migrate to locations accessible for monitoring will be far longer than the times presently being discussed as suitable for reliance on the existence of institutional controls. DOE PS at II-302. Any acceptable design must therefore be based on confidence in the analysis of repository performance rather than reliance on monitoring and action plans after decommissioning. DOE PS, Ref. II-190.

Before the start of construction, a thorough study at the site and the environs will be performed and documented, including a study of the naturally occurring isotopes present in the ground water. DOE PS at III-8 to III-24. This environmental monitoring will be repeated periodically throughout construction, operation, and decommissioning.

If NRC regulations ultimately require post-closure monitoring, or if it is deemed prudent to have such a program, the exact nature of the monitoring will be defined as part of any repository licensing proceedings. As previously stated, DOE PS at II-285, the Department is contemplating continued monitoring of the site environment after closure as a prudent measure and is prepared to examine the desirability and need for such monitoring in consultation with local, State, and other Federal agencies.

The Department concurs with the California Department of Conservation's statement, CDC PS at 24, that the monitoring issue should be carefully examined by an independent interdisciplinary committee of technical

experts. The peer review process which is being brought to bear on such issues is addressed in the Department's Statement of Position. DOE PS at II-23. The State of New York's comment, NY PS at 100, that "DOE has utterly sidestepped the monitoring problem" is not substantiated and appears to be written without regard to the institutional constraints, technical considerations, and site and repository specific considerations that must be factored into addressing the issue. The State of New York has ignored the fact that the Department is addressing the much more difficult task of assuring safety and environmental acceptability without reliance on active controls (monitoring and action plans). This approach relegates long-term monitoring to the status of a nonsafety-related issue. Nonetheless, the Department will continue to address long-term monitoring. Were society to accept long-term active control measures, the requirements imposed on waste disposal systems would be less stringent than those that are now being applied.

NRDC refers to several problems it observes in present Department of Energy waste management monitoring programs. NRDC PS at 57-58. It is claimed that monitoring programs (i) have failed to collect data necessary to accurately predict the presence or extent of a problem, (ii) have not included a periodic review of procedures, and (iii) have not provided plans for follow-up actions, once a problem has been detected. Id. Investigations of the performance of the repository system under both expected and unexpected conditions include an identification of parameters that will most likely affect the repository performance and those that will most likely be affected by it. These investigations are leading to definition of which parameters must be measured and how this can best be accomplished (61). Independent review of these monitoring programs by regulatory authorities will check the adequacy of the data collected.

Several types of follow-up procedures might be called for, depending upon the stage at which phenomena are measured by monitoring programs. If during the investigation of the suitability of a site, undesirable properties are found, actions are and will be taken to evaluate the impact of these properties and, if necessary, remove the site from further consideration. The elimination of the Palestine dome in Texas is an example of the latter action as a result of observations. See DOE PS at II-106. Similarly,

detection of unfavorable characteristics during the construction of a repository may lead to modification of the repository design or abandonment of the site. The broad range of the Department's programs provides sufficient flexibility for such actions without any lessening of confidence in the successful outcome of the program.

Detection of unfavorable conditions during the operation or post-closure phases of repository operations could result in a number of different responses. Modifications may be required in the operating techniques of the repository, retrieval of all wastes and unloading of the repository may be required; DOE PS at II-280 to II-283; or, in some instances, emergency procedures may be called for. Although evaluations conducted to date have not identified events that will require off-site emergency response plans, the Department has stated an intention to develop such plans in conjunction with State and local governments. DOE PS at II-280.

The capability of installed instrumentation to detect and quantify a problem under emergency conditions in reactors has been the subject of an extensive Department study (62-66). Similar studies will be undertaken for repositories and it is expected that the specification guidance contained in the above-referenced reactor emergency preparedness series will be utilized in the selection of monitoring instrumentation for a repository.

Concerning the periodic review of procedures, the necessity for such reviews is specified in a recent report on implementing the 'ALARA' concept at Department installations (67). Consistent with this document and past guidelines, periodic reviews of monitoring procedures will take place. DOE PS, Ref. II-736 to II-771.

One Participant expresses concern over the likelihood that the necessary monitoring equipment will be available ". . . at the time the repository goes into operation." CDC PS at 18-19. The similarity of a repository to other types of underground operations and to the operations of other nuclear fuel cycle facilities provides that monitoring equipment used in these facilities can also be used for repository monitoring. During the operating period, the major corridors and shafts of the repository will be open, thus permitting access for instrument maintenance. Since the instrumentation can be maintained during this period, exceptionally long-lived instruments will not be necessary for obtaining repository performance data.

Following closure of the repository, the major repository monitoring concern is whether it will be necessary to transmit data from the repository to the surface and, if so, how to do so without compromising repository integrity. Ongoing studies are addressing this issue (68, 69). These studies are looking at hardwiring (metallic wire, glass fibers, etc.) as well as wireless telemetry approaches. Currently available long-term monitoring instrumentation is also presently being evaluated. Several studies have examined the alternative methods of long-term monitoring of specific repository performance parameters, e.g., radiological and rock mechanics. Preliminary results of these studies have defined the appropriate parameters to be included in the monitoring program, the required instrumentation to be utilized and anticipated instrumentation performance characteristics. These studies will shortly be published and used for planning of any further development. However, examination of these reports and reviews of ongoing studies indicates that the current technology is adequate to form the basis for post-closure monitoring.

In summary, the Department recognizes both operational and post-closure monitoring concerns. It is evident that current monitoring capabilities can be used to monitor the repository during the operating period. Post-closure monitoring of the overall operation of the repository system as verified by the absence of observable environmental effects or traces of radioactivity is clearly achievable today. The degree to which remote monitoring of conditions within the repository after closure will be required is not yet determined. Current repository concepts, however, in no way rely on this requirement. Should it be determined that such remote monitoring would be desirable, existing communication techniques may be applied.

II.B.5.6 Human Intrusion

Some Participants express concerns related to the likelihood and significance of potential future human intrusion activities, i.e., activities that could lead to degradation of the repository isolation system over the long term. Contentions that no confidence can be found in mined geologic disposal are based on a perceived incentive for intrusion due to the intrinsic

value of spent fuel or resources associated with salt deposits; a perceived lack of effective preventive and mitigative measures to protect against intrusion, and the perceived consequences of intrusion. Conversely, other Participants suggest that human intrusion can be successfully controlled using measures similar to those discussed in the Department's Statement. DOE PS at II-193.

Three Participants suggest that, if a repository were sited in domed or bedded salt, the resources associated with these media (e.g., potash, natural gas, or oil), as well as the intrinsic value of salt, would invite future human intrusion. These Participants consider salt to be proscribed by draft NRC and EPA siting criteria that would require the site to be chosen to avoid potentially attractive targets for future exploration or resource exploitation. NRDC PS at 30, 33-35, 37; MN PS, Abrahamson at 7; NY PS at 49-50.

The criteria established by the Department relative to resources and land use require an analysis of the likelihood and consequences of human activities to explore for and/or recover resources. DOE PS at II-83. Such is also the apparent intent of draft criteria by the NRC and EPA, although, as discussed in Section II.A.4 of this Cross-Statement, those draft criteria do not form an appropriate basis for judging the Department's program at this time. The abundance of salt in this country makes any given repository site's salt content an insignificant factor in siting. DOE PS, Ref. II-280 at 2. In the case of salt domes, exploration at depth for other resources occurs at or beyond dome flanks, not in the central area where a repository would be located. Similarly, the likelihood of intrusion into bedded salt repositories can be made low by avoiding areas underlain by known deep resources, such as oil or gas, and by placing the repository below the depth normally exploited for resources such as potash. The areal extent of a bedded salt repository is very small in relation to the areal extent of a salt bed; this fact would lead to a relatively low probability of a random intrusion event (e.g., wildcat drilling). The determination of the significance of resources at a given site relative to potential human intrusion will be made on a case-by-case basis considering the relative location and value of the resources.

The knowledge of the existence of the repository, which will be perpetuated using measures such as those previously described by the Depart-

ment, DOE PS at II-193, will act to further reduce the likelihood of inadvertent intrusion. As one Participant notes, our present ability to record and disseminate information provides high assurance that, short of an extraordinary worldwide calamity, knowledge of the existence of the repository will prevail for many centuries. UNWVG-EEI PS, Doc. 3 at 2-32 to 2-36. Also, the waste package and site conditions will effectively mitigate the impacts of intrusion events and protect the public health and safety. DOE PS at II-196; USGS PS at 10.

Another Participant raises a corollary issue that the intrinsic value of spent fuel and/or high-level waste as potential bomb material would result in recovery of the material for such purposes. Lewis PS at 4. This contention presupposes planned intrusion. The contention is highly speculative and does not take into account the extreme difficulty of such a task; it would require a large, industrial-scale mining and chemical processing operation. As noted by another Participant, the depth of the repository would make such intrusion unlikely and very difficult. UNWVG-EEI PS, Doc. 3 at 3-24. Recovery of spent fuel would be possible; however, due to the massive effort required, the surreptitious recovery, which Mr. Lewis fears, would be unlikely.

The Department has indicated a need for additional study to ". . . fully develop methods to protect against the occurrence of human induced releases." DOE PS at II-189. One Participant, NECNP PS at 19, mistakenly interprets that statement as being in violation of Department's sixth objective for waste disposal, DOE PS at II-18, which requires that the technology be reasonably available. The passage in the Department's Position Statement at II-189 means that ongoing studies are directed at further developing and implementing the protective measures against human intrusion. Although work remains to be performed to perfect some of the protective methods described, these methods will be developed using available technology; i.e., scientific breakthroughs are not required. Development of protective methods using available technology in no way violates Objective 6 as the NECNP suggests. The Department asserts that protective measures such as those it has described, DOE PS at II-183, are reasonably available in the context of the repository development schedules set forth in the Department's Position Statement. DOE PS at III-9 and III-11.

One Participant alleges that not only is it impossible to prevent intrusion; NY PS at 5, 49, 50; but that intrusion would "dramatically" breach the repository and lead to substantial releases of radioactivity. NY PS at 31. The latter part of the contention is attributed to "common sense" by that Participant. In order to buttress its argument, that Participant cites statements by others that intrusion cannot be prevented. NY PS at 49, 50. Literally interpreted, however, the statements cited simply mean that, since nothing can be made to work forever, it is reasonable to assume that someday intrusion might occur. Those statements do not support the conclusion reached by the State of New York that any intrusion that did occur would be significant. UNWGMG-EEI, Doc. 2 at II-G-7 and Doc. 3 at 2-36. The State of New York chooses to ignore the effectiveness of the engineered and natural systems in mitigating waste releases; this conclusion is apparently based solely on "common sense" that contradicts the essence of nearly all of the scientific literature on mined geologic disposal published throughout the world over the last 25 years, which indicates that mined geologic disposal will result in inconsequential releases to the environment. See, e.g., UNWGMG-EEI, Doc. 3 at 2-32 to 2-36; and DOE PS at II-226 to II-236.

Another Participant recommends that surveillance of the repository be required for a minimum of 600 years after decommissioning to prevent human intrusion during that period of time. DE PS at 6. The State of Delaware also recommends that an action plan be developed to deal with such intrusion should it occur. Such measures rely on long-term institutional stability and are not consistent with the 100-year institutional control limit proposed by the EPA. DOE PS, Ref. II-5. Furthermore, the repository system will be sited and designed to protect the public without reliance on such measures. See also II.B.5.5 of this Cross-Statement. The advisability of incorporating long-term institutional control measures would be best reviewed at the time of repository decommissioning.

In summary the issue of possible human intrusion does not invalidate the use of salt as a host medium. Measures to protect against human intrusion are reasonably available and do not require scientific breakthroughs. The natural and engineered barrier systems will effectively mitigate the consequences of intrusion events should they occur. Finally,

surreptitious entry into a decommissioned and isolated repository is extremely unlikely because of the massive effort required to exhume and process the wastes.

II.B.6 Technical Issues Related to Site Characterization

Various Participants make statements about the viability of specific geologic media and the characterization, selection, or development of sites for mined geologic disposal. These comments include discussions of (i) the role of hydrologic testing and hydrologic modeling in characterizing a site, (ii) the amount of geologic information to adequately predict system performance, (iii) the choice of an appropriate geologic medium, (iv) specific concerns about candidate media, (v) the methodology for selecting sites, and (vi) the use of in situ testing to verify sites and models for performance assessment. Each of these points with appropriate references to the Department's Initial Statement is discussed in the following sections.

II.B.6.1 Hydrology

It is generally accepted that the most likely mechanism for any transport of radionuclides away from a repository is by the movement of ground water. DOE PS at II-76. Ground water may be expected to circulate through strata above and below a repository horizon; in some disposal media, there may occur circulating ground water at the level of the repository. The importance of the presence of such fluids to the isolation of the waste forces careful investigation of the hydraulic setting of the repository. The site selection and characterization process will determine whether or not the ground water system at a particular site will allow the degree of isolation required. DOE PS at II-77. The Department submits; DOE PS at II-76, II-237; that there are techniques applicable to the study of flow in porous media and to a lesser extent the flow in fractured media that are a part of the standard repertoire of practicing hydrologists. These allow sufficient description of the hydraulic system for assessments of the performance of the repository system. Id.

The California Department of Conservation has suggested that the " . . . state-of-the-art is not well-enough advanced to adequately de-

scribe the regime of deep, nuclear waste repositories . . . (for) performance assessment." CDC PS at 15. It is further stated that water flow is often controlled by infrequent anomalous regions which cannot be anticipated and remain conspicuously nonresponsive to drillhole testing. In response, it is necessary to point out that deep systems obey the same physical laws as shallow ones, and the deep systems which have been modeled and described so far, including several geothermal systems, have been done satisfactorily (70-72). The points of contention in these models are usually concerned with more arcane technical aspects (i.e., proper equations of state, stress relief in the model, multiphase representations). Data problems associated with inhomogenous media are well known in hydrology as evidenced by the application of sophisticated mathematical techniques, e.g. Kriging, to the data (73). The probability of locating "anomalous" regions can always be improved by increasing the number of wells drilled. This probability is also the highest when the anomalous region is large and hence has most effect on the hydrologic flow system.

The California Energy Commission contends that there are remaining data gaps, one of which concerns hydrology and the problems of ensuring the absence of circulating ground water. CEC PS at 10. For some media, there will indeed be circulating ground water. It is not necessary to guarantee the absence of circulating ground water, but rather to ensure that the hydraulic system is well enough understood that any interaction with the repository may be reasonably assessed. Several calculations are cited in which it is assumed that there is circulating ground water reaching the repository; these examples indicate that it is possible for water reaching the waste not to lead to extreme consequences. DOE PS at II-223 to II-231. The gaps in hydrologic modeling, as stated in the Department's Position Statement, are related: (i) to obtaining site specific parameters which is part of the site characterization process (DOE PS at II-76 to II-77); (ii) to refinement of models for movement of fluids in fractured rock (DOE PS at II-212); and (iii) to radionuclide speciation and sorption, which are discussed in II.B.3.2., supra. DOE PS at II-212.

The State of New York insists that, if a repository is breached and water transport occurs, the disruption will continue and grow. "When a

closed system springs a leak, everything inside can get out." This Participant further insists that the likelihood of significant releases is compounded by the fact that during a million years many breaches will occur, each one capable of releasing significant radiation. NY PS at 31-32. See also II.B.5.6 of this Cross-Statement. The expectations of this Participant are for the certainty of many unlikely events. Such simplistic conclusions about impending disaster are not consistent with observations of stable hydrologic settings at many places on Earth, including developed mines. Apparently unappreciated was the discussion of scenarios for release where a description of the events of the kind that bother the Participant are developed so their consequences can be estimated. DOE PS at II-208. Moreover, extensive efforts by a large number of scientists have not revealed the situations that the State of New York asserts are obvious. DOE PS at II-208; UNWGMG-EEI PS, Doc. 3 at A-1 to A-28.

Three Participants are concerned with the hydraulic properties of rocks. NECNP PS at 17; WN PS, Mudrey at 3; CDC PS at 17. The first of these Participants cites the Department's admission that present techniques of measurements may be in error by up to a few orders of magnitude for nearly impermeable rocks. While uncertainty in specific parameters always will be present in hydrologic analyses, it is possible to bound the range of the transmissivities at a particular site and to determine consequences for the high values. Furthermore, in cases where hydraulic conductivities are low, concern over differences of precision in measurements of even several orders of magnitude obscures the fact that they are already sufficiently low. These uncertainties can also be compensated by the engineering design of the repository; e.g., the Swedish system for granite repositories in which the waste package and backfill are used to protect the waste from water intrusion. DOE PS, Ref. II-340, II-345, II-346.

The second Participant is concerned with specific technical problems, principally of the effects on the hydrology of existing fracture systems and of fracture systems activated by the repository. WN PS, Mudrey at 3. The California Department of Conservation questions the characterization of specific hydrologic parameters, the effects of climatic changes, and the certainty of sufficient knowledge of hydrologic variables to reliably

model repository performance. CDC PS at 17. These contentions are recognized by the Department and are the objects of current study. Studies are being done in granite and in basalt to investigate exactly such questions. DOE PS at II-251; II-255 to II-263; II-267 to II-268. Study and modeling of any site includes both modeling of the site as it is now, in order to understand the salient features there, and modeling of the site as it might be affected by the repository and by natural processes. The latter studies try to determine what are the bounds of the physical processes to which the site might be subjected. Studies to date have incorporated consideration of a wide range of natural phenomena, including climatic changes, glaciation, deformation of host rock, and earthquakes. DOE PS at II-208. Clearly, an exact prediction is not possible, but the range of variation can be predicted with some confidence. It is this range of variation that is modeled to decide whether there is a reasonable expectation of assurance of acceptable consequences.

The State of Wisconsin points out that the waters currently in a granite mass may not be representative solutions for corrosion, leaching, and transport of radionuclides. WN PS, Mudrey at 5. The Department's program is specifically addressing this concern. Current performance assessment models will accept variations in release rates from the source and have accounted for the variation of ground water composition by examining the speciation and amounts of radionuclides. Possible consequences of action of the solute, which depend on the volume of the waters as well as their past history, will fall within some bounds. Various solutes falling within the bounds of interest are used as leachants and corrosives to determine the speciation of radionuclides and rates of degradation of the waste package. These solutes are further modified by incorporation of the buffering effects of waste package components and ionizing radiation. DOE PS at II-150.

NECNP contends that the Department's arguments; DOE PS II-76, II-98; employing bounding assumptions are evidence that the Department is able to develop a vague idea of hydrologic characteristics of various sites but is not able to determine specific performance of a site leading to a conclusion that it is qualified as a waste repository site. NECNP PS at 22. It is certainly true that site-specific studies will be required as specific repository sites are identified. It is possible, however, to determine the range of variation of essential parameters in the medium of interest and to apply the

models using these ranges to assess whether continued investigation is reasonable. Site-specific data included in the models will provide more superior assessments during the repository licensing process. Site-specific characteristics, in fact, have been obtained by the Department and incorporated into overall performance assessments. DOE PS, Ref. II-192 and II-670.

The same Participant expressed concern about the lack of site-specific data of the salt domes. NECNP PS at 23. It is true that the Department has not completed characterization of the hydraulic systems at these domes. The Department has established, however, the general properties of those hydraulic systems, and has good reason to expect a lack of a ground water threat to a repository. DOE PS at B-5 to B-18. This knowledge and ability is based on the existence of domes, experiences in mining domes, and the continued operation of the Asse II experimental facility in a salt dome in the Federal Republic of Germany. DOE PS at II-253 to II-255.

In summary, most of the concerns expressed about hydrologic modeling in site characterization are based on an unfamiliarity with techniques for performance assessment methodology, in which uncertainty in processes or conditions can be incorporated into scenario specification and bounding parameters. Furthermore, the specific issues relating to deficiencies in the technology for hydrologic analyses have not only been included in the scope of these bounding calculations but are being addressed by the Department in its model development, laboratory, and field studies.

II.B.6.2 Geologic Information

A few Participants discuss the present lack of some geologic information. NECNP PS at 21-22; NY PS at 44-48; CDC PS at 8-10; SHL PS at 1-2. The State of New York specifically contends that not enough is known to predict either earthquakes or re-glaciation and that such occurrences could affect repository performance. NY PS at 46-48. The three other Participants cited above offer sweeping suggestions that a lack of certain geologic information, which they fail to specify, precludes a finding of confidence in the use of geologic repositories for disposal of nuclear wastes.

These suggestions ignore the vast body of data presented in the Department's Statement of Position; DOE PS, Parts II and III, and App. B; and

the many references cited therein. That body of data establishes the efficacy of the concept of geologic disposal. A specific example of evidence of the feasibility of the concept is provided at the site of a uranium mine (Oklo) in Gabon, West Africa. See also Section II.B.3.3. of this Cross-Statement. The Department's Position Statement pointed out in this regard:

Certain regions accreted enough very rich ore to become 'critical' and sustain a fission chain reaction for several hundred thousand years. More than 10 tons of wastes, comparable in nearly every respect to the products generated by a modern power reactor, were formed in the buried ore where they have been exposed to dispersive natural processes ever since. Yet the majority of the waste products are still at or near the original site. DOE PS at II-140.

The contention that uncertainty in effectiveness of geologic disposal arises from difficulty in proving this effectiveness may most logically be addressed by considering the objection in two parts: first, in light of the scientific process involved, and second, in evaluation of the uniqueness of geologic systems. The scientific process that allows the adoption of a concept without knowing absolutely all there is to know relative to that concept is described in II.B.2 of this Cross-Statement. The uniqueness in the evaluation of geologic systems arises from some uncertainties relative to the prediction of geologic processes.

The contention that scientists cannot "guarantee" future stability, NECNP PS at 116, is correct. The State of New York and NECNP, however, fail to recognize the manner in which the uncertainties are bounded and accounted for through conservative design of the total system. The conservative approach described by the Department in its Position Statement considers the remote potential for catastrophic events in scenario analyses. See DOE PS at II-22 to II-26. The absence of an ability to predict future geologic processes and events with absolute certainty does not preclude conservatively bounding their likelihood and potential effects. DOE PS at II-101 to II-102. An example of this approach is presented in the Department's Statement as it relates to tectonic events. DOE PS at II-102 to II-103. Although no absolute guarantees are available regarding any one particular event, the total repository system is to be conservatively designed in such a fashion that redundancy of engineered and natural barriers will provide for any uncertainties in the realm of geologic prediction.

The contention that "Simple projection into the future from local geologic history alone is not a satisfactory basis for repository site selection" is true. NY PS at 45. That is why the Department has developed the elaborate and detailed plans relative to the siting process which are presented throughout the Department's Statement.

All sciences (with the possible exception of mathematics) look to past experience and phenomena for insight into future behavior. Thus, the USGS Statement that geology is "a retrodictive rather than a predictive science," quoted by the State of New York, NY PS at 44, is in no way an indictment of the capacity of science to provide answers to currently unknown or poorly understood phenomena. DOE PS, Ref. II-115. Utilization of a record of prior events, whether preserved in geologic history or in results of recently performed laboratory analyses in chemistry or physics, is the essence of the scientific approach, without which our modern industrial society would not exist.

The State of New York contends ". . . that we are simply unable to predict long-term geologic processes." NY PS at 44. To support the contention, it offers an observation made by the USGS which the Participant quotes: "(U)se of the geologic record to predict future events is a formidable task." NY PS at 44. It is illogical to assume that, because something is difficult, it cannot be done. For additional support the Participant again quotes the USGS. NY PS at 44. The quote states in part ". . . there appears to be no clear philosophical basis for determining rates for these events or processes in the future." (emphasis added). The key word is "determining." It is not necessary to determine specific rates at specific future points in time in order to conservatively bound such rates and apply the boundary conditions to a performance model. In contrast to the conclusions drawn by the State of New York, the Acting Director of the USGS concluded in the foreword of that same USGS report that "the many weaknesses in geologic knowledge noted in this report warrant a conservative approach to the development of geologic repositories . . .," and further that "the authors are confident that acceptable geologic repositories can be constructed"

The Department's siting process, coupled with performance assessment modeling techniques, precludes designation of a site where phenomena are demonstrated to have an unacceptably adverse affect on performance.

When evaluating potential effects from earthquakes, glaciation, or any other geologic process, the key to successful siting is a determination of how these processes affect performance. The absolute characterization of any postulated event is not required, provided that its degree of impact on the system can be bounded, then coupled with a performance model. The model will incorporate this uncertainty and determine whether or not other system components provide the necessary mitigating measures. For a detailed discussion of technical issues related to performance assessment, See II.B.3 of this Cross-Statement.

In conclusion, the Participants whose Statements are cited above have ignored the body of data and existing natural phenomena that support the feasibility of the concept of geologic disposal. They fail to recognize the integration of the siting process and performance assessment modeling, thereby drawing erroneous conclusions based solely on the premise that, because long-term processes cannot be absolutely characterized, there can be no assurance of repository performance. Focusing on specific geologic uncertainties, they have given no credence to the interrelationship of the total system's components. In addition, the State of New York confuses the issue by use of incomplete and out-of-context quotations. The siting process and performance modeling techniques described in the Department's Statement remain a viable means for achievement of the Department's objectives.

II.B.6.3 Choice of Geologic Medium

It has been alleged by three Participants that current information is insufficient to support a finding of confidence that any host rock will be found that is suitable for a waste repository. NY PS at 78, 84; NRDC PS at 36, 48; CDC PS at 9-10. It is stated that properties of potential host rocks and their interactions with radioactive wastes are not understood. NY PS at 78. This contention is inconsistent with the large amount of technical data presented in the Department's Position Statement and the references therein. To further support its suggestions, technical issues are raised by the State of New York for each of the media under investigation by the Department. NY PS at 84-92. These issues are systematically addressed in this Cross-Statement in Sections II.B.4.1, II.B.5.1, and II.B.6.4.

Suggestions concerning the choice of a geologic medium attempt to focus attention toward achieving the best or perfect medium instead of an adequate medium. CDC PS at 9. They further attempt to interject confusion by implying that, since many media are being evaluated and R&D efforts are in process for many media, none is acceptable. NRDC PS at 48. These Participants ignore the Department's discussion on available information on media in regions under investigation in current exploratory programs. DOE PS at B-1 to B-80. More importantly, these suggestions provide no evidence that uncertainty associated with scientific knowledge about any medium has adverse implications about the adequacy of the medium in providing safe and environmentally acceptable waste isolation. The Department, on the other hand, submits that sufficient information is available to bound the effects of any uncertainties regarding the characterization of host rock, the response of host rock to heat and radiation, and the interaction of the waste and the rock. Bounding cases can then be considered in the overall assessment of the repository performance as presented in the Department's Position Statement. DOE PS at II-206 to II-207. The Department's position is supported by at least one other Participant. UNWVG-EEI PS, Doc. 3 at 3-29.

These suggestions about being able to select a geologic medium thus reflect a confusion between the desire to improve understanding over the current data base and the need for complete and perfect knowledge; the latter is not necessary to identify or choose an adequate medium or site.

II.B.6.4 Issues Related to Specific Media

Various Participants make statements about the adequacy of specific media for development of a mined geologic repository. Specific issues are raised about (i) salt, (ii) basalt, (iii) granite, and (iv) shale. These issues with appropriate references to the Department's initial Statement are presented in the following subsections.

II.B.6.4.1 Salt

A number of issues have been raised about the suitability of salt as a host rock for a mined geologic disposal system. Two Participants

maintain that salt will be unsuitable because of its solubility. NY PS at 85-86, MAD PS at 1-2. The solubility of salt has been known for centuries. The Department is keenly aware of the potential significance of solubility. Considerable research has been done, and will continue, to define methods for further evaluating dissolution and predicting dissolution rates, as well as the potential for and location of the phenomenon. DOE PS, Ref. B-24. Sites can be identified in which salt deposits have been and will continue to be protected from dissolution mechanisms over long periods of time. For example, millions of years would be required for dissolution to reach anticipated repository depth at the Los Medanos site. DOE PS, Ref. B-38. Considerable information relative to dissolution around boreholes indicates that dissolution is not significant. DOE PS, Ref. II-509 to II-511. The contention that the rate and extent of salt dissolution by brine are unknown, NY PS at 84, is unsupported and ignores the comments found in the Department's Statement. DOE PS at B-30 to B-31, B-38 to B-39. Salt dissolution has in fact undergone thorough examination and has been addressed in detail in several references cited in the Department's Position Statement. DOE PS, Ref. II-282, II-285, II-287 to II-288.

The contention of serious consequences associated with the migration of brine to heat sources in salt; MAD PS at 2; NY PS at 85; have been discounted by analyses and experimental data from the Department's R&D program. Likewise, the recognition of the creep behavior of salt by the State of New York, NY PS at 81, and its suggestion of potential "collapse" of a salt formation are indicative of an unfamiliarity with both a well-studied phenomena encountered in many engineering applications and the extensive, well documented, body of data supporting models to predict creep behavior in salt. These topics are further discussed in Section II.B.5.1 of this Cross-Statement.

A concern regarding breccia pipes is addressed by the State of New York. NY PS at 84. Breccia pipes do exist in bedded-salt basins, have been recognized, studied in detail, and rates of dissolution carefully calculated. Breccia pipes are generally associated with a salt-dissolution front along the edges of salt basins with through-flowing hydrologic systems. A major objective of the siting process is to thoroughly characterize the geologic/hydrologic systems involved, and to identify potential repository sites where breccia pipes are not anticipated. DOE PS at B-38 to B-39.

The State of New York also expressed concern about the environmental hazard that might be posed by mined salt. NY PS at 85. The potential for an environmental hazard developing as mined salt is brought to the surface has been covered in detail (74). The report concludes that there are multiple options for the disposal of mined waste, all of which provide satisfactory mitigation of the potential impacts.

One NRDC contention concerning placing a repository in salt is false: that ". . . the geologic community, at least here in the U.S., has all but abandoned both salt and Carlsbad. . . ." NRDC PS at 84. No evidence was presented to indicate that any consensus of opinion of the "geologic community" relative to the use of salt as a potential repository host medium has ever been established.

NRDC further maintains that NRC criteria appear to rule out salt because it is a valuable resource and is locally associated with other valuable resources. NRDC PS at 4, 37. This contention also is wrong. See II.B.5.6 of this Cross-Statement.

The contention that salt is highly corrosive; NRDC PS at 37; MAD PS at 1, 2; and as such presents a problem toward development of suitable engineered barriers is addressed in II.B.4.3 of this Cross-Statement.

In summary, the allegations of the above-cited Participants ignore the large body of existing information and the programs that address what they have labeled as problems. The Department recognizes that some uncertainties do exist relative to the performance of salt as a repository medium, and has programs in progress to address these uncertainties. The extensive data obtained to date have not revealed any information about domed or bedded salt which would render either unsuitable as a medium for mined geologic disposal.

II.B.6.4.2 Basalt

Three Participants assert that there is no basis for confidence today that the Hanford basalts can safely isolate high-level waste from man. NY PS at 92; NRDC PS at 38-40; and CDC PS at 16-17. The Participants base their assumption on small excerpts from several references that do not accurately reflect the current status of knowledge about the Hanford basalts.

For example, the State of New York, NY PS at 92, references the Interagency Review Group on Nuclear Waste Management, Subgroup Report on Alternative Technology Strategies for the Isolation of Nuclear Waste, TID-28818, (1978) Appendix A, page 81. DOE PS, Ref. II-3. The page referred to by the State of New York discusses unsaturated rocks found in the southwestern United States and lists basalt only for completeness. It does not refer to the flood basalts currently being studied and characterized as a part of the Basalt Waste Isolation Project. A much more accurate reference to the Basalt Waste Isolation Project can be found on page 76 of Appendix A of the same IRG Subgroup report.

The State of New York says, "Because the thermal conductivity of basalt is low, the waste would have to be cooled at the earth's surface for several decades prior to emplacement." NY PS at 92. This position also is based on the IRG reference. The State of New York apparently overlooked a passage in this same reference on page 76, which states, "Basalt has moderate thermal conductivity and has a high melting temperature. Basalt apparently has the ability to withstand a high thermal load in a repository." As is shown in the Department's Position Statement, the basalt host rock maximum temperature is not expected to exceed 2600C. DOE PS at II-67. This temperature is far below the melting temperature of basalt, and does not exceed the temperature range for which a waste package can be effectively designed. As indicated in the Department's Statement, DOE PS at II-118, several reports are now available that show confidence that the Hanford basalts could safely contain a high-level waste repository if site-specific conditions continue to look favorable. DOE PS Ref II-289 to II-293.

Two other Participants question the suitability of basalts at Hanford as a waste disposal media because of the presence of aquifers in the basalt flows. CDC PS at 16-17, NRDC PS at 38-39. The producing aquifers in the Pasco Basin basalts that are sources of irrigation water are found between 500 feet and 800 feet below ground surface. At the proposed repository depths of 3,700 feet, the basalt horizon is dense and relatively impermeable with a thickness of about 225 feet. DOE PS, Ref. II-293. Available data suggest that water bearing units tend to become less permeable with increased depth. The vertical permeability at repository depth (approximately 3,700 feet) is

extremely low. DOE PS, Ref. II-293. The California Department of Conservation states, "There is also an aquifer only a few hundred feet below the proposed host rock, suggesting a travel path from the proposed repository to this aquifer which would be very short." CDC PS at 17. While it is true that aquifers could exist below the proposed horizon, current data show that the hydraulic gradient is vertical, with the lower aquifers being of higher hydraulic head than those above the proposed horizon. DOE PS, Ref. II-130. This type of gradient would not support the movement of material from the repository down to a higher pressure area. In addition, the time required for transport from the repository to the biosphere is the parameter of highest importance, not the linear distance from the waste to a possible flow path.

The NRDC references a report by the National Academy of Sciences (NAS) written in 1966. NRDC PS at 34. In addition to noting that the report is 14 years old, it should be observed that basalt as a storage medium for radioactive waste at Hanford was not considered by the NAS in 1966. The primary emphasis at that time was disposal of high-level waste in the dry sediments above the regional water table. Three years after the NAS studies were published, an exploratory borehole was drilled to characterize the basalts underlying the Hanford Site. The data obtained from that and subsequent boreholes are leading to confidence that the hydrologic, structural, and sorptive characteristics of the Hanford basalts can provide a suitable medium for disposal of radioactive wastes.

Consideration of the current information available and discussed above leads to the following conclusions:

1. The basalt flows at Hanford, specifically those at proposed repository depth, are highly impermeable and capable of providing geologic containment. Further, at Hanford there is no evidence that the water bearing formations at depth are connected with surface aquifers used for irrigation. Based on current information lateral ground water movement tends to predominate the deep aquifer flow systems. This flow direction greatly increases the travel path (time) to the biosphere.
2. Available information leads toward the conclusion that the Hanford basalts can safely contain a

high-level waste repository. Continuing investigations are underway to resolve any remaining deep hydrology questions.

II.B.6.4.3 Granite

The State of New York's Statement contends that granite has serious defects as a repository medium. NY PS at 91. The National Resources Defense Council contends that granitic rocks are attractive for repository siting because they occur as massive dense blocks but maintains that "a significant amount of research must be initiated to more clearly understand the problem of fracture permeability." NRDC PS at 49.

The State of New York's contention is apparently based on two quotations from the literature. The first indicates that granite may deform under "high confining pressure, high temperature or long term stress, and will decompose at surface temperatures and pressures." NY PS at 91. The first quotation cited by the State of New York (75) was apparently submitted by the NRC Staff on the draft EIS on the Management of Commercially Generated Radioactive Waste to assure the overall scientific accuracy of that document. Although, as noted, granite may undergo deformation under the influence of pressure, time, and temperature, such deformations will be small and certainly manageable for the levels of these phenomena predicted in a repository. Similarly, given the anticipated time frame (on the order of several tens of years) for exposure of granitic rocks to ambient temperature and pressure in a repository excavation, the mineral components of granite would be relatively inactive chemically. Decomposition of granite into well-developed regoliths under conditions of surface temperature and pressure is a phenomenon requiring periods of time that are orders of magnitude greater than those expected for similar physical conditions in a repository. In support of this, one needs only to observe that the granitic rocks in Yosemite Valley, which have been exposed since the Pleistocene, display minimal, if any, regolith development.

The State of New York similarly misconstrues the thrust of the second document quoted to support its contention--an EPA report by an "ad hoc panel of earth scientists" (76). Reading beyond the quotation cited in the State of New York's Statement; NY PS at 91; to the summary in the EPA report, the following quotation is found:

It is the Panel's opinion, and apparently that of several foreign countries as well, that a sizable body of granite underlying a hydrologic basin of appropriate dimensions may prove, in the long run, to be an excellent underground repository. We know of no reasons, as yet, to rule it out (77).

The State of New York further ignores the fact that granitic rocks in the solid phase have already endured temperatures during cooling in excess of those that would result from exposure to nuclear waste. Furthermore, to induce phase changes would require temperatures well in excess of those generated by nuclear waste. See DOE PS, Ref. II-465. In addition, granitic rocks have been locally subjected to long-term conditions of high confining pressure for billions of years, without having been substantially altered save for some increased fracturing. Id. This alone attests to their local capacity for endurance and tendency toward stability relative to the scale of environmental and geologic events imposed upon them.

The suitability of granite as a host rock is also attested to by the National Academy of Science, Committee on Radioactive Waste Management's review of the KBS-II plan for disposal of spent fuel in Swedish granitic bedrock, which concluded:

In the Subcommittee's judgment, supported by onsite visits, the existence of bedrock areas in Sweden suitable for repository sites has been adequately demonstrated. DOE PS, Ref. II-380 at 15.

In addition, foreign experience in granite field testing is being incorporated into the Department's program to develop a broad data base. Other Participants have recognized the large amount of experience that exists in development of nuclear waste geologic repositories in foreign countries. ANS PS at 18, AIF PS at 17, and SE 2-CN PS at 21.

The Department thus submits that the State of New York's suggestion that granite has serious defects as a repository medium is without merit. With regard to the National Resource Defense Council's comment that additional research into granite is required, the Department already has described ongoing work in this area in its Position Statement. DOE PS at II-94 to II-98 and II-258 to II-260. The Department submits that continuing development of these techniques combined with bounding analyses of repository performance provide confidence in the suitability of granites.

II.B.6.4.4 Shale

It is suggested that there are " . . . numerous drawbacks to the designation of shale" NY PS at 90. Shale has been identified as a potential medium for a repository and the Department has supported a limited amount of work to determine the suitability of shale for this purpose. The status of the Department's studies in shale are addressed at various places in the Department's Statement. See, e.g., DOE PS at II-126, II-264 to II-267, II-175. Further discussion of the response of shale to thermal loads is presented in Section II.B.5.1 of this Cross-Statement. All of the shale characteristics outlined in the State of New York's Statement, NY PS at 90, can be addressed by laboratory and field studies as previously indicated in the Department's Statement. It is misleading to imply that the properties noted are drawbacks. Once the response of individual shales to such phenomena as heat, radiation, mechanical stress, etc., have been determined, a designer has the options of (i) utilizing the shale's response characteristics to advantage (e.g., using swelling properties to aid isolation), (ii) designing the repository to avoid conditions that would decrease isolation (e.g., limiting temperatures to avoid uplift), or (iii) determining that a specific shale is not desirable for a host rock. The Participant's characterization of shale's properties as "drawbacks" at this stage of investigations is premature.

The assertion in the State of New York's Statement that ". . . run-off of acids derived from a shale constituent will cause adverse environmental consequences" (emphasis added); NY PS at 91; ignores the fact that mitigating measures would be taken by the Department were a repository to be developed in shale. For example, recent information indicates that many options exist for acceptable mitigation of such impacts, and the technology is available to exercise these options (78). See also II.B.5.4 of this Cross-Statement. The assertion that "Shale, like basalt, is usually interbedded with potential aquifers"; NRDC PS at 43; is, likewise, unsupported speculation and an overgeneralization which attempts to stereotype highly variable rock formations. The significance of the existence of potential aquifers depends upon a specific site's stratigraphy and the characteristics of "potential aquifers."

Therefore, there is no scientific evidence that shale should not be considered as a potential repository medium; hence, the Department has

identified several areas in which more work concerning the suitability of shale can be conducted. DOE PS at B-72. The attractive properties of shale provide a basis for its continued study by the Department as a potential host rock.

II.B.6.5 Existence of Qualified Sites

It is the contention of a few Participants that the Department's site selection methodology will not result in acceptable sites on the basis that, as more data are obtained, each potential site will be found to have disqualifying flaws. The experiment at Lyons, Kansas (Project Salt Vault) and the Palestine (Texas) dome are cited as examples of past failures by the Federal Government to site repositories. CDC PS at 24-5; NECNP PS at 23; NY PS at 61.

As discussed in the Department's Position Statement, DOE PS at II-251, Project Salt Vault was designed to establish the feasibility of and techniques for the safe disposal of high level waste in a bedded salt formation. The experiments, involving electrical heaters and fully retrievable emplacement of spent fuel, achieved their intended purpose to provide data on thermomechanical response of rock salt to heat and radiation. These experiments were completed in 1967. The criteria for choosing a site for short-lived experiments, like those undertaken in Project Salt Vault, can be much less restrictive than those required for permanent disposal sites; i.e., long-term isolation need not be considered for short-lived experiments. It is thus not surprising that the site of the Salt Vault experiments encountered site suitability questions when subjected to the more detailed scrutiny required to establish a permanent repository. Although the site was ultimately dropped from consideration as a permanent disposal site, the lessons learned from that experience, both technical and political, have been beneficial in formulating the present program.

Disqualification of the Palestine dome is an example of the site exploration process working properly. See DOE PS at II-106. Qualified sites are to be found by a screening process that subjects geographical areas to ever-closer scrutiny. DOE PS at III-15 et seq. See also USGS PS at 17.

The screening process is expected to winnow out or disqualify land areas and geologic formations. Through that process the preferred locations and, finally, qualified sites emerge. It is erroneous to assert that the elimination of sites in a process based on winnowing or screening is in some way a failure of the process and indicative of the fate of all locations ever to be examined.

Not all potentially qualified sites can be expected to be qualified to exactly the same manner and degree, but any qualified site will have to meet siting requirements. The designation of a perfect site is not required to safely isolate radioactive wastes. See also II.B.2 of this Cross-Statement. The site characterization and selection activities will identify and analyze the favorable and unfavorable conditions of the studied locations and determine, on balance, the suitability of potential sites. The environmental review process will add to the public review of the trade-offs for each alternative site. Further, the Commission will provide an independent safety assessment of the candidate site and proposed facility designs.

The New England Coalition on Nuclear Pollution also contends that all of the sites under investigation " . . . suffer to a significant degree from a lack of important data or information necessary to evaluate them." NECNP PS at 23-24. It is obvious that important information remains to be gathered; otherwise, the selection of sites could occur today rather than on the schedule set forth in the Department's Statement. DOE PS at II-81. The New England Coalition's suggestion is a misinterpretation of the status of the program which confuses this record by suggesting that a properly working site selection process is a basis for no confidence.

Similarly, the New England Coalition on Nuclear Pollution's assertion that the Department must support its contention regarding resources at Richton Dome, NECNP PS at 29, is nothing more than a statement of what is commonly understood to be part of the site selection, NEPA, and licensing processes. The quotation taken from the Department's Statement; DOE PS at B-15, referenced in NECNP-PS at 29; is factual and appropriate for the current stage of the siting process. Any site selected as a final alternative would undergo rigorous scrutiny for all safety and environmental factors.

Assertions made by the Participants that failure to yet qualify a site through the lengthy and rigorous prescribed process in any way indi-

cates an absence of qualified sites, therefore, appear to be founded on a misunderstanding of the technical site screening process. Indeed, it is the position of the Association of Engineering Geologists that:

. . . radioactive nuclear wastes can be safely isolated and disposed of by deep underground burial in secure geological environments. The scientific and technical means to locate and define the boundaries of these environs and to achieve such safe disposal is well developed and increasing. AEG PS at 1.

That Association's policy reflects the consensus opinion of its membership, which numbers 3,000 members worldwide, all of whom have seen and had the opportunity to comment upon its Statement (79).

In summary, the contention that the site selection methodology will not result in acceptable sites cannot be supported simply by reference to the Department's or its predecessor agency's rejections of specific sites. These actions, in fact, confirm that the process is working. The lack of complete information at sites under investigation does not indicate that the site selection process is not working, but rather supports the requirement to continue with a thorough and complete evaluation.

II.B.6.6 In Situ Testing

Three Participants observe that in situ testing is an essential part of the technology development for successful waste isolation. NY PS at 60; NRDC PS at 50; and CEC PS at 17. This is consistent with the Department's Position Statement in which the reasons for in situ testing, DOE PS at II-248, the relationship of in situ testing to the development program, DOE PS at II-249, and its role in supporting repository design, DOE PS at II-250, are stated. At issue, however, is the degree of testing necessary to allow evaluations of the performance of a repository at a given site. The State of New York contends that no site can be assumed acceptable until in situ testing has been conducted for many years. NY PS at 61. The Department, however, submits that sufficient information can be obtained from site characterization activities and past, current, and planned in situ tests to provide sufficient data

and model confirmation to perform the bounding performance assessments necessary to submit a license application for a given site. Furthermore, if conditions at a particular site warrant, more extensive underground in situ testing can be performed to further verify the site and associated repository design. The stepwise approach implemented by the Department will allow for further sequential testing of important system features as the repository is constructed and operated. DOE PS III-9 to III-11, III-21 to III-22.

NRDC contends that more emphasis should have been placed on in situ waste/rock interaction studies; hence data collection and verification lag far behind the Department's optimistic estimates for repository construction and waste acceptance. NRDC PS at 53. This contention is inconsistent with the large body of experimental data from (i) laboratory and bench-scale studies which have simulated in situ conditions for waste/rock interactions associated with the waste package; DOE PS at II-137 to II-150; (ii) in situ tests simulating thermal and thermomechanical effects, DOE PS II-248 to II-268; and (iii) in situ experiments with actual waste forms or radionuclides which have been performed or are in progress. DOE PS at II-251 to II-254, II-260 to II-263. Moreover, although additional testing of local waste/rock interaction with actual waste forms is planned by the Department; DOE PS, Ref. II-234; undue emphasis on limited duration experiments can be inappropriate, because these effects can be reasonably bounded in a system assessment of repository performance.

The California Energy Commission emphasizes the necessity for correlation between in situ testing and predictive models and suggests a methodology for implementing an in situ testing program. CEC PS at 16-17. The correlation with modeling is already a fundamental part of the Department's program as evidenced by its Position Statement. DOE PS at II-242 to II-270. Furthermore, the approach suggested by the California Energy Commission is consistent with the bases, planning, implementation management, peer review, and system integration of in situ tests now in the NWTS Program. DOE PS, Ref. II-570.

Upon review of limited data from existing in situ testing programs, the California Energy Commission argues that pretest predictions are wrong as often as they are right and that vigorous hypothesis testing and model verification have not been the objectives of any in situ tests. CEC at

73. These rather sweeping subjective judgments are based on limited information, as acknowledged by the California Energy Commission. CEC PS at 66. Moreover, they fail to recognize the important "feedback loops" between experimental results and model development, in which results continually refine and improve the accuracy of models by identifying the effects of synergisms and the relative importance of various parameters. The importance of this process is evidenced by the recent progress in the maturity of models in the NWS system today. DOE PS II-198 to II-242.

The California Energy Commission further contends that none of the experiments have yielded definitive and satisfying results relating to long-term radionuclide isolation. CEC PS at 73. This contention discounts the Department's Position Statement, which agrees that additional in situ testing is necessary but asserts that in situ testing is but one phase of an integrated strategy of model development, laboratory tests, in situ tests, and observation of natural analogs. DOE PS at II-243, II-244. This approach allows progress in the development of models for long-term isolation and the gathering of data via the most appropriate method.

The California Energy Commission also stated that it is uncertain whether the Department intends to fully exploit the field testing capabilities of the Stripa facility in Sweden for further assessments of granite as a suitable repository host rock. CEC PS at 70. At issue is the unavailability of a written work plan for a proposed multinational (U.S., Sweden, Canada, Finland, Switzerland) project in Stripa to examine buffer mass tests, bedrock pressure tests, water uptake tests, tunnel and shaft sealing, and hydrologic field tests. It was explained in the referenced telephone communication between the California Energy Commission and R.A. Robinson, on 19 June 1980, that this multinational project was in the initial stages of development. Proposals on the technical subjects mentioned above were being evaluated at that time by a Joint Technical Committee composed of participants from each member country. The Department plans to enter into formal agreements (i.e., Bilateral and Nuclear Energy Agency Stripa Project Agreements) and start the project in late 1980. Along with the Stripa facility, other test facilities in granitic host rocks are also being used by the Department to assess the suitability of granite as a repository host rock. DOE PS at II-251.

The adequacy of in situ testing programs is questioned by the NRDC, which contends that the applicability of the Hanford Near-Surface Test Facility is in doubt, since the basalt flow at the test site is significantly different from that at the proposed repository horizon. NRDC at 53-54. NRDC has misrepresented the purpose and objectives of the Hanford tests, which are stated in the Department's Position Statement. DOE PS at II-249. In situ testing is one phase of a sequential research and development program. The Near Surface Test Facility is being used for development of models specific to basalt and evaluation of the capabilities of models for predicting effects. In addition to gaining specific test results, the Near Surface Test Facility is also being used to determine optimum excavation techniques for use in basalts, and to develop and evaluate techniques for further in situ tests. As specifically stated by the Department, the objectives of the test are to measure thermomechanical properties, establish limits for thermal loadings, compare modeling predictions with field data, and evaluate the impacts of radiation. DOE PS at II-267. The Department has never contended that all conditions in the Near Surface Test Facility are the same as those that will be found at depth. The Department fully anticipates that additional observations will be made at depth prior to any emplacement of radioactive wastes for permanent disposal.

In summary, the Department has incorporated in situ testing into its program to assure adequate site characterization and verification and to verify the models used for performance assessment. The program is sufficiently flexible to allow adequate evaluation of given sites and repository designs. Additional studies will be performed, including experiments on waste/rock interactions with radioactive sources in a manner compatible with a methodical verification of predictive models. In situ tests, to date, have aided in the significant increase in the maturity of the computational models and experimental base and support a finding of confidence in the feasibility of mined geologic disposal.

II.B.7 Alternative Disposal Methods

One Participant contends that the Department of Energy has, without basis, dismissed alternatives to mined geologic disposal. ECNP PS at

4. As indicated in the Department's Statement, mined geologic disposal was adopted consistent with the President's 12 February 1980 Statement; DOE PS, App. A; and IRG recommendations, as an interim planning strategy. DOE PS at II-28 to II-30. The basis for that decision is set forth in Section II.B of the Department's Statement in which each of several alternative methods of disposal is discussed. DOE PS at II-27 to II-42. As explained in that section of the Department's Statement of Position, other disposal methods, such as subseabed disposal, are being explored.

The Final EIS on the Management of Commercially Generated Radioactive Waste, to be published later this year, will provide the evaluation of environmental issues needed to support the Department's final decision on its planning strategy for waste disposal. The decision will be based on an objective determination of which method(s) best meet(s) the Department's objectives for waste disposal, DOE PS at II-7 to II-21, considering safety, environmental acceptability, and socioeconomic issues, and the appropriate time frame for establishing an operating disposal system. The adoption of mined geologic disposal as an interim planning strategy is consistent with information described in the Department's Position Statement and the Draft Environmental Impact Statement on the "Management of Commercially-Generated Radioactive Waste" published and circulated for public comment in 1979.

II.C TECHNICAL ISSUES RELATED TO STORAGE

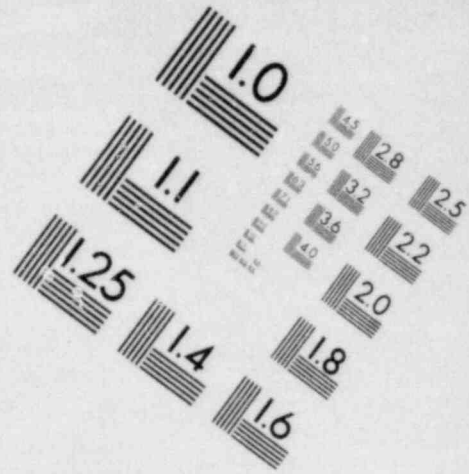
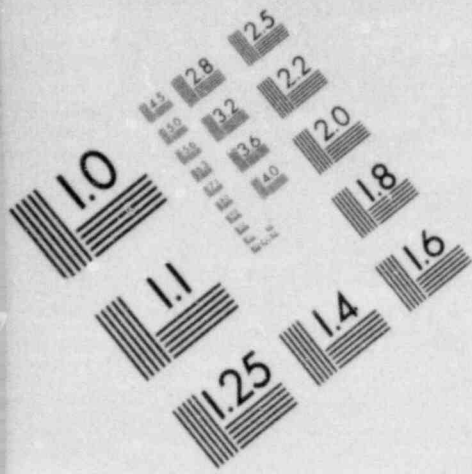
The Statements of Position filed by the other Participants address several issues related to the technical viability of spent nuclear fuel storage. As in the case of technical issues related to disposal discussed above, a significant number of Statements endorse and enhance the technical basis for the conclusions regarding storage of spent fuel set forth in the Department's Statement of Position. A few, however, assert that certain technical issues preclude a finding of confidence at this time. The Department, as noted previously, has performed a detailed review of all the Statements filed. In this portion of the Cross-Statement, the technical issues related to storage raised by the Participants are addressed by subject area.

Several Participants contend that there is no basis for confidence that spent nuclear fuel can be safely stored on-site or elsewhere for extended periods. NECNP PS at 3-4; NRDG PS at 7, 88-93; IL PS at 3,5; SHL PS at 5-6; MN PS at 9, 32-35. The Department submits that this is not true, as demonstrated in the Department's Position Statement and the Statements of some other Participants. For example, General Electric Company states that, based on its direct experience in design, licensing, construction, installation, and operation of spent-fuel storage systems, there are no technical mechanisms that prevent the safe and extended storage of spent fuel in either an at-reactor (AR) or away-from-reactor (AFR) storage facility, and that such storage involves no significant risks or environmental impacts. GE PS at 2-3. The Tennessee Valley Authority states that, based on its specific operational experience, there appears to be no reason why spent fuel cannot be safely stored in AFR storage facilities or at reactors for the life of the plant or longer. TVA PS at 6, and App. at 5-7. UNWVG-EEI states that storage of spent fuel under water either at reactors or in AFR storage facilities for many decades is a safe, proven technology. UNWVG-EEI PS, Doc. 1 at 26. Several other Participants also conclude that spent fuel can be safely stored on-site or elsewhere for long periods of time in a safe and environmentally acceptable manner. ANS PS at 34; AIChE PS at 3-4; AIF PS at 34.

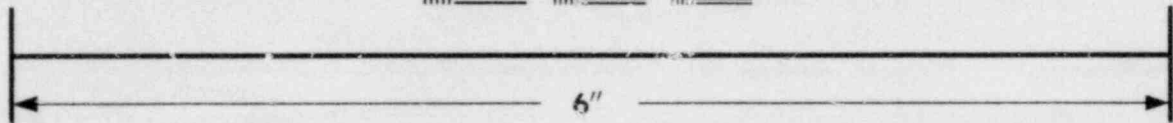
The bases for confidence that interim storage of spent fuel is a viable approach until disposal technology is available are delineated in the Department's Position Statement. DOE PS at IV-40 to IV-74. These bases are summarized below:

1. The technology to store spent nuclear fuel in water has developed through more than 30 years experience. DOE PS at IV-9. See also UNWVG-EEI PS, Doc. 4 at 17; AIF PS at 34. It is familiar, relatively simple, and involves low temperatures and benign environments. Extensive operational experience has demonstrated that relatively few abnormal events are encountered in the storage operation and that such are mitigated by the storage system design. DOE PS at IV-56 and IV-70.

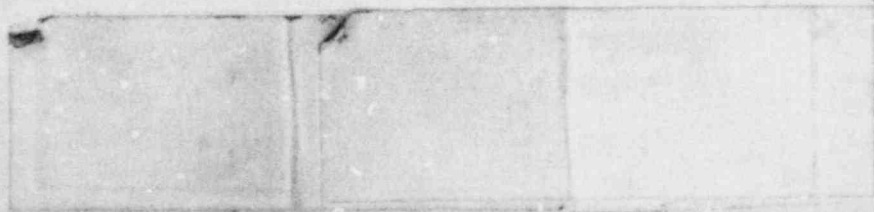
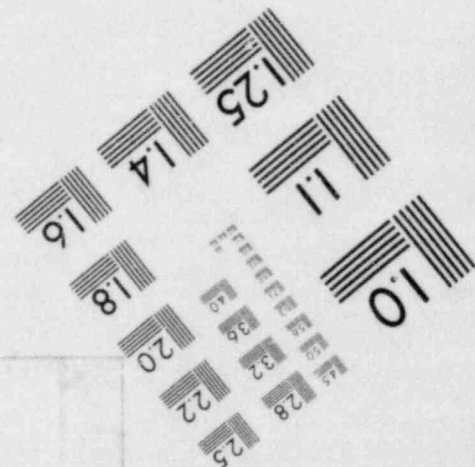
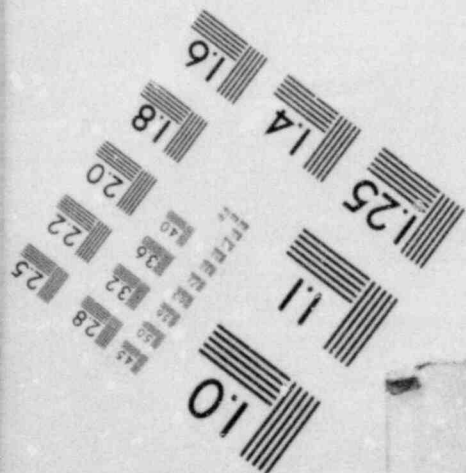
2. An extensive corrosion data-base, including effects of irradiation, has been developed for zirconium alloys used for nuclear reactor cladding and components. That data-base predicts a high resistance of Zircaloy cladding to failure under pool storage conditions, based on eight assessments which scrutinized zirconium alloy corrosion behavior during pool storage (80). DOE PS, Refs. IV-15, IV-78, IV-80, IV-82 to 85. Cf, UNWGMG-EEI PS, Doc. 4 at 20. The inventory of stainless-clad water reactor fuel also has an extensive corrosion data-base which predicts very low oxidation rates. Spent-fuel examinations are under way to investigate susceptibility of the stainless cladding under storage conditions. DOE PS at IV-62.
3. Several levels of surveillance have been applied to define the condition of spent reactor fuel during pool storage, including visual and radiation monitoring at all pools, non-destructive and/or destructive examinations of spent fuel in Canada, Federal Republic of Germany, the United Kingdom and the United States. There are commitments to continue surveillance of spent fuel over the period of interim storage in Canadian, German (F.R.G.), United Kingdom, and United States programs. DOE PS at IV-58 to IV-60.
4. An international program on behavior of fuel assemblies in storage (BEFAST) is in place under the Nuclear Energy Agency (NEA) to coordinate national spent fuel programs relating to interim storage. DOE PS at IV-59. The BEFAST program provides a broad perspective to the current status of spent-fuel behavior, and provides a focus for the national R&D programs in this area of technology. At a recent (July 1980) BEFAST meeting in Paris, which delegates from 12 countries attended, there was general agreement that the important aspects of spent fuel surveillance are being addressed in existing national programs. There were no new observations suggesting that spent reactor fuel is degrading during storage, thus reinforcing previous observations in this regard.
5. A world survey of spent-fuel storage experience is under way, sponsored jointly by the International Atomic Energy Agency (IAEA) and the BEFAST Program. Questionnaires were sent to 22 countries with nuclear programs; 18 nations responded.

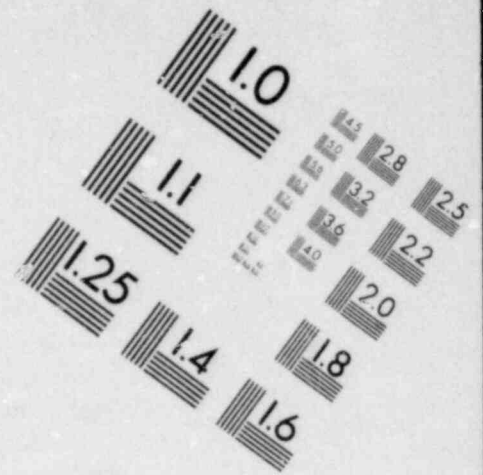
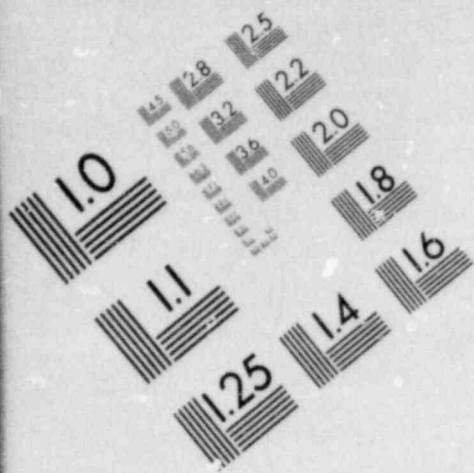


**IMAGE EVALUATION
TEST TARGET (MT-3)**

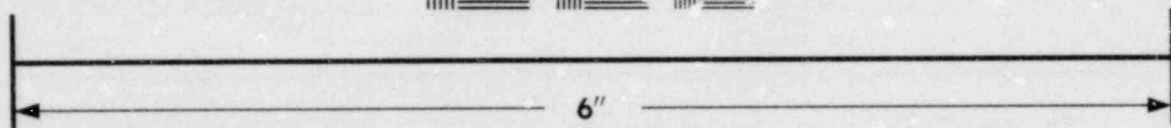


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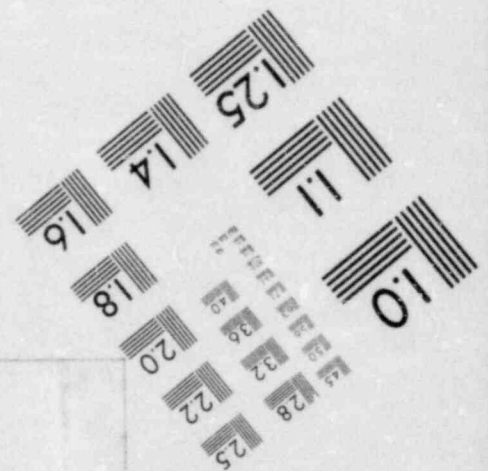
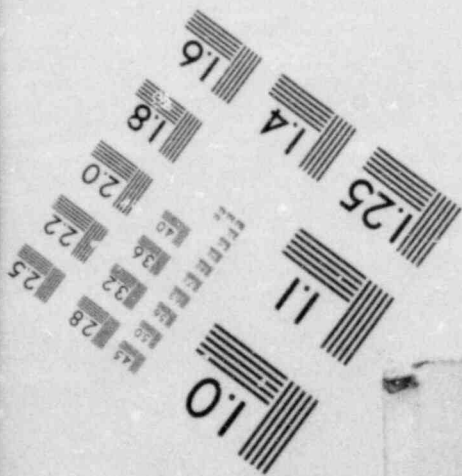




**IMAGE EVALUATION
TEST TARGET (MT-3)**



MICROCOPY RESOLUTION TEST CHART



One important question which was posed to each spent-fuel pool operator was whether or not any evidence had been seen that spent water reactor fuel is degrading during water storage. The answer in every case was that there has been no evidence of water reactor fuel degradation in pool storage. This is an important result because fuel types which have been found to corrode in water pools, Magnox* and Zircaloy-clad metallic uranium with clad defects, give clear evidence that corrosion is occurring, including hydrogen bubbles and increases in pool water radiation levels.

6. The data-base summarized above results from 35 years of successful storage performance. The bases include up to 20 years of continuous storage for Zircaloy-clad fuel and 12 years of continuous storage for stainless-clad fuel. It includes extensive corrosion studies directed to irradiated fuel cladding materials. It includes visual, non-destructive and destructive examinations of pool-stored fuel,** all of which suggest that no detectable degradation has occurred. DOE PS at IV-57. See also UNWGMG-EEI PS, Doc. 4 at 7-11. Even if some cladding degradation were eventually to develop, extended successful interim storage would not be jeopardized. In the first place, a certain number of cladding failures could be tolerated without impacting pool operation or public health and safety. The number would depend on the type of failures and when they occurred. Second, if the degree of cladding degradation warranted, the degrading spent fuel could be encapsulated (canned), and replaced in the water pools. This is an existing procedure for some types of fuel with reactor-induced defects. DOE PS at IV-71 to IV-72. See also AIChE PS at 4; UNWGMG-EEI PS, Doc. 3-4 at 22. Alternatively, dry storage can serve as a backup interim storage procedure. Dry storage has been used for several types of spent fuel including HTGR, Magnox, PWR, and PHWR spent fuels. DOE PS at IV-12 to IV-19 and IV-63.

*Magnesium-clad gas reactor fuel.

**Examinations of stainless-clad fuel are still in progress.

Based on the foregoing, the Department submits that the existing data-base for integrity of spent water reactor fuel and the availability of backup procedures justifies a finding of confidence that interim storage will be a reliable element of spent-fuel management.

New England Coalition on Nuclear Pollution asserts that the Department's Statement of Position contains a number of misleading statements concerning spent-fuel storage pool design. NECNP PS at 58. This Participant specifically cites the Department's observation concerning multiple barriers to release of radioactivity from spent fuel, DOE PS at IV-30, which was intended to emphasize the barriers that exist when spent fuel is stored in a pool designed to the criteria described. The fuel itself possesses characteristics (incorporated by its design) that enable it to withstand the reactor operating environment, and the barriers provided thereby are supplemented by the additional barriers cited, which are inherent features of storage pool design. The Department does not contend that away-from-reactor storage facilities provide additional unique barriers not available at reactor sites, nor does it find any reason why such should be provided.

Another contention by this Participant is that control of heavy loads at reactor fuel pools is ". . . a potential problem at most existing AR pools." NECNP PS at 59. In support of this contention, the Participant cites a Commission report on unresolved safety issues related to nuclear power plants (81) The issue of fuel pool accidents at nuclear power plants has been examined by the Commission in its reactor safety analysis (82) and in its GEIS on spent fuel storage. DOE PS Ref. IV-1 at ES-9 and at Appendix B-6. The Commission's position on this issue is set forth as follows:

It is the NRC staff's view that continued operation during review of this generic issue presents no undue risk to the health and safety of the public. Operating facilities use a variety of design and administration measures to minimize the potential for dropping a heavy object over the reactor core or over the spent fuel pool.... For facilities that have requested increases in spent fuel storage capacity, the NRC has prohibited the movement of loads over fuel assemblies in the spent fuel pool that weight more than the equivalent weight of one fuel assembly. And for those plants where the review of the cask drop or the crane handling system is not complete, movement of shielded casks over or near spent fuel has been prohibited. *Id.* at A-16.

The Department submits that its treatment of this potential problem is not inconsistent with the Commission's position as stated above.

The State of Minnesota alleges that the Department's Statement indicates that the longest Zircaloy spent-fuel storage time is 16 years. MN PS at 33. This is a misinterpretation of the Department's analysis of the Canadian storage experience. DOE PS at IV-10. The cited storage time applies to Zircaloy-clad spent fuel stored in Canada only. The longest storage time for U.S. Zircaloy-clad fuel is 21 years. DOE PS at IV-54. However, as explained above, six Zircaloy-clad assemblies resided in the Shippingport reactor from 1959 to 1974, reaching a burnup of 40,900 MWD/MTU. They have been in water storage since 1974 and were recently examined. DOE PS, Ref. IV-85. The total time exposed to water under reactor and pool conditions, therefore, is 23 years.

Another Participant notes that reactor storage basins were designed only for the temporary cooling and storage of spent fuel. OC PS at 3, 12. The Participant contends that Commission licensing of expanded storage facilities at reactors violates the multibarrier principle and is a safety hazard and that it represents a makeshift answer to a storage problem that was devised as a response to a safety evaluation. OC PS at 12. Reactor storage basins are licensed by the Commission under 10 CFR Part 50 as a component of a nuclear generating station. Such operating licenses are generally issued for an effective period of 40 years, which is the expected economic life of the facility. If, however, the facility should prove to have a longer economic life, as many fossil-fueled plants have, a license renewal could be effected unless there were a safety consideration that would prevent such. In any event, there does not appear to be any reason why the storage pool could not continue to be licensed past the economic life of the plant. The nuclear power plants that are currently operating and those in advanced stages of construction were originally designed under the assumption that only one or two discharges of spent fuel would be stored in the reactor basin and that a discharge of the complete core might have to be stored therein in addition to such discharges. It should be pointed out that the functions of a spent-fuel storage pool are to provide shielding from radiation, to provide protection against release of radioactive materials into the environment, and to provide protection against the possibility of accidental criticality. Shielding is

provided by the water in the pool and the reinforced concrete structure. Protection against the release of radiation is provided by cooling of the fuel by the water in the pool and by the removal of traces of radioactive material from the water by the pool cleanup system. Protection against accidental criticality is provided by spacing between fuel assemblies and/or neutron poisons, and by structural restraints. DOE PS at IV-40 to IV-70.

While reactor storage basins were intended only for the temporary cooling and storage of spent fuel, they were designed to perform this temporary cooling and storage function continuously for the 40-year economic life of the plant. There is no reason why these facilities could not be used to perform this function for a number of years past the assumed 40-year economic life of the facility, provided that they were properly maintained. Moreover, these basins were designed to store extremely highly radioactive fuel--that which was out of the reactor for less than 2 years, including a full core discharge which had received the benefit of little decay of radioactivity.

The expansion of storage facilities does not impinge on the number of barriers present to protect against the release of radioactivity to the environment and, therefore, does not present a significant increase in the hazard potential of spent fuel storage. The four basic barriers to release of radioactivity are the fuel pellet, the fuel cladding, the storage pool and water purification system, and the building structure and associated ventilation system. DOE PS at IV-30. None of these barriers is breached or compromised by expansion of existing storage pools; there is more spent fuel present, but the barriers are still there.

NECNP raises a number of issues from the Commission's hearings on Commonwealth Edison Company's application for a license amendment to allow reracking of the storage pool at the Zion nuclear power plant. NECNP at 72-73; 124-169. These issues were considered by the Atomic Safety and Licensing Board in that proceeding and a ruling was issued permitting the reracking (83). In view of the fact that all these issues have been reviewed by the Commission and resolved thereby to the extent necessary to authorize the reracking to proceed, the Department has determined that it would be inappropriate to address them again in this Cross-Statement.

Finally, one Participant states that the U.S. spent-fuel storage inventory was 13 metric tons at the end of 1977. SE2-CN PS at 17. This cited value is in error; the correct value is about 4,000 MT (84).

II.C.2 Technical Issues Related to Integrity and Longevity of Spent Fuel

A few Participants raise specific technical issues related to integrity and longevity of spent fuel. NECNP states that there is little experience with the handling and storage of aged or defective fuel with high burnups now anticipated for future fuel design. NECNP PS at 56. To date, the inventory of spent fuel with burnups above 40,000 MWd/MTU is small; some examples are cited in the Department's Position Statement. DOE PS at IV-54, Table IV-13. Experience, however, has not shown evidence of any burnup-related degradation mechanism. Several high-burnup demonstration programs are under way to investigate approaches to more fully utilize uranium resources. DOE PS, Ref. IV-70. The Department's Spent Fuel and Fuel Pool Component Integrity Program for some time has been in contact with these programs and has an understanding that high-burnup demonstration assemblies will be available for the Department's surveillance program. Periodic observations of the high burnup assemblies during pool storage will provide a basis to anticipate any problems which might develop during storage several years before a significant inventory of high burnup fuel is expected to develop. Exposure of nuclear fuel to higher burnups would have favorable effects on spent-fuel storage because the spent-fuel inventory would rise at a slower rate.

Six Shippingport reactor Zircaloy-clad fuel assemblies remained in-core from 1957 to 1974 (40,980 EFPH*) the majority of time at 280°C, reaching a fast neutron exposure of 78×10^{20} . The maximum burnup was 40,900 MWd/MTU. Three of the fuel assemblies were examined after 3 years of pool storage. Maximum oxide thicknesses were 20 μ m. There was no evidence of significant degradation. This fuel was aged, in a sense, under worst-case conditions, i.e., under reactor operation. DOE PS Ref. IV-87.

*Effective Full Power Hours: the number of hours the fuel was at the equivalent of full reactor power, combining full and partial power operation.

The Kraftwerk Union is performing periodic non-destructive surveillance on 28 PWR spent fuel rods with burnups of up to 39,000 MWD/MTU. DOE PS at IV-60. Ten of the rods, with burnups to 26,000 MWD/MTU, have obvious reactor-induced defects which are photographed periodically. Since discharge in 1975, there have not been any detectable changes in the form of the defects. Observations at Karlsruhe (F.R.G.) and Windscale (U.K.) on defects in irradiated Zircaloy cladding indicated no detectable changes in 5 years and 9 years, respectively. DOE PS at IV-60 and IV-61.

In summary, fuel inspections have not shown evidence that fuel burnup is a factor in degradation of either intact or defective spent reactor fuel. However, further confirmations are under way to increase the Department's data-base in the storage of such fuel by incorporation of high-burnup fuel into the Department's spent fuel surveillance program.

The State of Minnesota quotes from Hon. Mr. Justice Parker, who presided at the 1977-78 Windscale Inquiry in the United Kingdom. MN PS at 33-34. The Windscale summary referred to by the State of Minnesota suggests, "That Zircaloy fuel may be stored up to 20 years . . .," and "It would be imprudent to store substantial quantities of stainless steel clad fuel in pools for more than a decade." The Windscale statements must be read in the context of the understanding of spent-fuel storage which then prevailed and the fact they involved British gas reactor fuel. British gas reactor fuel (with Magnox and stainless steel claddings) had degraded during water storage, causing some concerns regarding other cladding types. DOE PS at IV-57. The evidence now available suggests that the types and rates of aqueous corrosion on the gas reactor fuel cladding are not occurring on water reactor fuel cladding. DOE PS at IV-57. Several important spent-fuel storage assessments and fuel examinations have become available since the Windscale hearing, as discussed in the following paragraph. The Windscale Inquiry reservations regarding storage of stainless-clad fuel were directed principally to the British gas reactor cladding, which sensitizes* during residence in the reactor and corrodes during water storage. Stainless-clad water reactor fuel cladding is

*Sensitization refers to changes that occur in stainless steel when it is exposed to temperatures in a range which includes the operating temperature of the gas-cooled reactors; the changes which occur significantly increase the susceptibility of stainless steel to corrosion (85).

irradiated at temperatures below the normal sensitization range. The water reactor stainless steel cladding has appeared to be resistant to corrosion in water pools. DOE PS at IV-62. However, additional examinations are under way on stainless-clad spent fuel to determine whether there is evidence of slow degradation. DOE PS at IV-58.

Several significant assessments; DOE PS, Refs. IV-78, IV-80, IV-84, IV-85 and (80); and fuel examinations; DOE PS, Refs. IV-78, IV-82, IV-87; have been completed since the Windscale Inquiry hearings. Without exception, the results suggest that water reactor spent fuel is resistant to degradation in water storage. For example, Canadian investigators conducted metallurgical examinations on Zircaloy-clad fuel with pool residence up to 16 years. Based on the absence of detectable degradation, the Canadian investigators indicated that:

These (conclusions) lead to the general conclusion that all evidence to date indicates that fuel can be stored safely in water for at least 50 years. DOE PS, Ref. 82.

Participant Dr. Lochstet addresses the question of on-site storage of spent fuel and maintains that in extended storage the spent fuel will " . . . become leaky and unsafe." Lochstet PS at 1. No evidence is cited by Dr. Lochstet to support that contention. In fact, the evidence now available suggests that pool storage of water reactor fuel for several decades can occur without substantial degradation, as discussed previously in this Cross-Statement. Dr. Lochstet's contention must be disregarded as unsupported and in contradiction to current evidence.

NECNP suggests that the ongoing programs to investigate and evaluate integrity of spent fuel during storage are very modest in scope and could be easily terminated from year to year through budget limitations imposed by the U.S. Congress. NECNP PS at 66. The Department has summarized several active programs both in the United States and in foreign countries, which will monitor spent fuel for as long as necessary to ensure that cladding degradation is not a problem. Foreign monitoring programs are being conducted in Canada, the Federal Republic of Germany, and the United Kingdom. DOE PS at IV-57 to IV-62. See also UNWGMG-EEI PS, Doc. 4 at 23. These programs are by no means a "modest" effort, and the Department is committed to continue to evaluate the integrity of spent fuel during storage. The programs

which the Department has described involve a substantially greater number of fuel rods than the nine rods referenced by NECNP, as is clear from the Department's Statement of Position. DOE PS at IV-57 to IV-62. The continued funding of the Department's waste management program is addressed in Section II.A.7 of this Cross-Statement.

In conclusion, the Department's analysis of the Statements of the other Participants reveals no reason to question the integrity of spent fuel from commercial reactors in water pool storage for the period of time until safe and environmentally acceptable disposal is available.

II.C.3 Technical Issues Related to Integrity and Longevity of Storage Pool Components

NECNP raises a few technical issues related to the integrity and longevity of storage pool components. It suggests that "Fuel pool water chemistry impurities are not as closely monitored or controlled." NECNP PS at 103. (It is not stated what comparison is being made, but it presumably is to the reactor coolant system.) The lack of monitoring and control is cited as a possible source of clad perforation, end plug cracks, and/or other means by which fission product gases or leachable species could be released. At most spent-fuel pools, the water chemistry is monitored weekly, rather than the daily or even several times daily sampling of the reactor coolant system. Because the spent-fuel pool temperatures are lower than in the reactor coolant system, corrosion processes occur more slowly. Therefore, the need for close monitoring is far less critical than it is for the high-temperature, high-pressure reactor coolant systems. Control of impurities in spent-fuel pools is accomplished by ion exchange to remove dissolved species, filtration to remove suspended particles and skimmers to remove species from the water surface. DOE PS at IV-7 and IV-70. These procedures maintain high-quality pool waters: for example, chloride levels typically are less than 0.15 ppm and frequently are less than 0.02 ppm. These levels are far below concentrations that promote corrosion of fuel cladding materials.

NECNP also discusses an event at the General Electric Company plant at Morris, Illinois, involving a freeze failure of tubes in a fin-fan cooler in the heat exchanger circuit, which allegedly leaked contaminated

water to the environment. NECNP PS at 65. This event was of minor significance. A recent discussion between Dr. A.B. Johnson and E.E. Voiland, Manager of G.E.- Morris facility, revealed that leakage from the cooler tube was a few gallons at most, involving water with a relatively low concentration of radioactivity ($4 \times 10^{-4} \mu\text{Ci/ml}$). The soil where the leakage dripped was removed for storage in two or three steel drums, precluding any significant impact on the environment.

NECNP claims that slow degradation of all fuel and storage pool materials, coupled with inability to establish a viable facility for terminal fuel disposal, could result in uncontrolled leakage of radioactive materials to the environment. NECNP PS at 67. The probabilities of water reactor spent fuel clad degradation have been shown to be low. DOE PS at IV-73. See also UNWGMG-EEI PS, Doc. 4 at 20-21. Even if numerous clad failures occurred in every spent-fuel pool, the relatively low inventory of volatile species in the rods and provisions for removal of dissolved or particulate species from the water would preclude significant health hazards to the public and to plant workers.

In about 20 years of spent-fuel pool history, adverse environmental impacts of spent-fuel pool operation have been minimal. In the relatively few cases where spent-fuel pool equipment has failed, the pool operators have been able to promptly replace the equipment or component. The record shows that spent-fuel pool materials degradation has been a minimal problem. Where it has occurred, spent-fuel pool operators have been able to deal with it on a safe and timely basis. Therefore, based on the available data and the investigations in progress, the Department submits that storage pool components will continue to function in a manner that provides safe and environmentally acceptable storage.

II.C.4 Technical Issues Related to Past Events at Spent-Fuel Storage Pools

One Participant discusses a few events that have occurred at spent-fuel storage pools. For example, the State of New York cites several Licensee Event Reports (LER's) involving abnormal events at spent-fuel pools.

NY PS at 105. The State of New York does not characterize these events in terms of their safety significance, but implies that ". . . several serious accidents have occurred." Id. In fact, the examples cited are for the most part leaks or accidental releases of liquids with low levels of radioactivity. While any technical process is subject to some equipment breakdowns, accidents, etc., water pool storage facilities have been operated with few serious problems. DOE PS at II-56 to II-57. See also UNWGMG-EEI PS, Doc. 4 at 26. In all cases, such events at spent-fuel pools have been manageable on a timely basis. Although there is no quantitative basis for comparison, the Department submits that spent-fuel pool technology compares very favorably to other technologies in respect to the number and severity of the events that have occurred.

In conclusion, the Department submits that the occurrence and severity of incidents at fuel pools compares favorably with other technologies. At the same time, it recognizes that the causes of abnormal events at spent-fuel pools must be identified and evaluated, and that appropriate measures must continue to be taken to eliminate the causes.

II.C.5 Technical Issues Related to Potential for Incidents During Storage

Comments from Participants on the subject of accidents and their potential consequences at spent-fuel storage facilities range from a lengthy description including nonspecific and unsupported references to numerous "accidents" in spent-fuel storage facilities, through a discussion of cases of leaks and inadvertent releases of contaminated storage pool water, to a suggestion that waste storage should be physically separated from reactor operation to reduce the risk of damage to the storage facility in event of a reactor accident, and vice versa. NY PS at 102-107; OC PS at 12.

The State of New York, in its discussion of possible accidents at spent-fuel storage pools, cites reports of an accident in the Soviet Union involving reprocessing plant wastes stored in tanks at a Soviet waste storage facility. NY PS at 107-108. Although this incident is interesting and has raised considerable speculation among non-Soviet specialists, it bears no relation whatsoever to the situation involved in water pool storage of spent

fuel. A recent report by experts from Oak Ridge National Laboratory (86) concludes that whatever actual releases may have occurred from this Soviet facility were materials which had been separated from reprocessed spent reactor fuel. The storage of such materials, separated from reprocessing waste associated with Soviet weapons activities, as liquids or sludges in tanks cannot be compared to the storage of ceramic fuel in metal cladding, surrounded by water of low radioactivity content. The issue raised, therefore, is not relevant to this proceeding.

NRDC has identified the requirement for continued management of pool storage facilities as a problem, in that it introduces the possibility of human errors or mismanagement. NRDC PS at 89-90. The State of New York, in commenting on a series of minor incidents at storage facilities, reported in the Commission's Licensee Event Report (LER) system, describes the Three Mile Island reactor accident as caused by multiple technical and human failures; and postulates that these failures are a possibility at storage facilities, with serious off-site consequences. NY PS at 107.

These observations reflect a complete disregard for the results of the numerous safety analyses that have been made of water pool storage and of alternative long-term storage methods and which have demonstrated this activity to be both safe and environmentally acceptable. Obviously, the possibility of human error cannot be completely eliminated; Commission regulations include explicit requirements for operator training, the use of written procedures for all safety-related operations and functions in the plant, and certification or licensing of operators, with the objective of minimizing the opportunity for human error.* The damage at the Three Mile Island reactor, however, resulted from the existence of two major driving forces for radioactive contamination, neither of which exists in a spent-fuel storage pool. These were:

1. A large inventory of reactor coolant at high temperature and high pressure, and

*See, e.g., 10 CFR Part 55, Operator's License; proposed 10 CFR Part 72, Sub-part I.

2. A reactor core with a rate of decay heat release many factors of 10 higher than that which characterizes aged reactor spent fuel.

The absence of these driving forces, and the presence of the built-in barriers in a water pool storage facility as described in the Department's Statement of Position, DOE PS at IV-29 to IV-33, make an accident with significant radiation consequences at such a facility of very low probability. In addition, design features are incorporated in each facility which are intended to mitigate the consequences of accidents caused by human error or otherwise, as discussed in the Department's Statement of Position. DOE PS at IV-34.

NRDC also cites the possibility of terrorist attacks on facilities or the possibility of war with accompanying social and political disintegration as arguments against the acceptability of extended interim storage of spent fuel. NRDC PS at 90. The intentional sabotage of a storage pool facility is a possibility recognized by both the Department and the Commission. Both agencies are taking steps to further tighten security at such facilities, the Commission by way of more stringent security requirements imposed on licensees, and the Department through more demanding procedures for access to its own facilities (87). It should be pointed out, however, that on-site storage of spent fuel is relatively invulnerable with respect to dispersion because of its physical form (solid ceramic material encapsulated in high-integrity metal cladding stored underwater within a reinforced concrete structure capable of withstanding the rigors of natural phenomena such as tornadoes, earthquakes, etc.). With respect to the concern expressed over the possible complications of war, the Department can only comment that there are potential targets more vulnerable than spent fuel.

In summary, the possibility of a major accident with off-site radiological consequences at a spent-fuel storage facility is extremely remote because of the characteristics of spent-fuel storage. These include the inherent nature of the spent fuel itself, the benign nature of the water pool storage environment, and the lack of any internal driving force for dispersion of radioactive material.

II.D

ISSUES RELATED TO TRANSPORTATION LOGISTICS

Some Participants express concerns related to the logistics of transporting spent fuel, including (i) the possibility that there will be an insufficient number of casks available to meet transport needs; (ii) the fact that railroads are being depended on for the bulk of the shipments; and (iii) whether the impact of the large number of shipments required has not been addressed sufficiently. These concerns are discussed in the following sections.

II.D.1

Shipping Cask Availability

The State of Wisconsin states that only about one-half of the current reactor sites are served by rail. WN PS, Deese at 6. In developing its Position Statement, the Department reviewed the Environmental Impact Statements (EIS) for each reactor that was operating or under construction. The results of this review showed that approximately 76% of currently operating reactors have rail access and that this percentage increases when reactors under construction are added to the consideration.

The same Participant points out that there are only 15 casks (6 rail and 9 truck casks) in existence and that a massive task remains ahead to meet transport needs. WN PS, Deese at 6. Another Participant estimates that the present cask fleet (including the four casks in the process of being re-certified) has a capacity for transporting 1,500 MTU/year, and that this would be sufficient to handle the needs until the mid-1990's. UNWVG-EEI PS, Doc. 4 at 40, 41.

There are at present 9 truck casks and 6 rail casks available in the U.S., excluding those 4 currently undergoing relicensing examination. DOE PC at VI-10. It is estimated that a total of 44 rail casks will be needed by 1997, which would require an approximate average of 2 rail casks to be built each year, commencing in 1980. After 1997, an approximate average of 18 rail casks would have to be built each year for a period of 6 years. Moreover, estimates indicate that a total of 14 truck casks will be needed by 1997, which would require the manufacture of only about 5 additional truck

casks prior to 1997, and thereafter an average of about 3 additional truck casks per year. DOE PS at VI-12. In view of the Department's conservative approach of arriving at the aforementioned cask requirements, which included assumptions of rail speeds of only 6 mph and extended turnaround times of casks at loading and unloading points, there is a good possibility that fewer casks will be required in actual practice. From the foregoing, it can be seen that neither the development of the necessary cask fleet over the next 17 years nor the additions required thereafter is a particularly massive task compared with other common industrial endeavors.

One Participant reasons that the design and licensing of new casks would not likely be a limiting factor in meeting the requirements for additional casks, since existing designs that are already licensed could be used to expedite delivery. This Participant quoted cask vendors' estimates of the lead time for construction of casks at 1-2 years for truck casks and 1-3 years for rail casks. Design of a new cask was estimated to require 1-3 years, with licensing requiring another year. UNWVG-EEI PS, Doc. 4 at 41-42. Another Participant stated that it requires less than a year to build a cask. SE2-CN PS at 14. As a result of surveys of cask suppliers by the Department, it has been determined that lead times for the construction of casks range from 12-24 months. DOE PS at VI-13.

One Participant commented that incentives for major investments in casks and other transportation systems appear to be vanishing as a result of emphasis on at-reactor storage. WN PS, Deese at 6. Two other Participants stated a belief that cask vendors would have incentive to meet future demands. UNWVG-EEI PS, Doc. 4 at 42, SE2-CN at 14. The Department has surveyed suppliers of shipping casks and services and has determined that there is sufficient industrial interest in the construction and furnishing of spent fuel shipping casks on a commercial basis to meet future demands. Cask suppliers have expressed considerable disappointment that the market for spent fuel shipping services has not grown as fast as once projected, and this situation has caused some organizations to retrench in their spent fuel shipping programs. Nonetheless, it is reasonable to expect that the organizations would expand their cask shipping capacity, and that others would enter the business, once it became clear that the market was developing--as evidenced by orders being placed. In addition, as noted in its initial Statement,

The Department has established a Transportation Technology Center at Sandia National Laboratories to follow the emerging needs for spent fuel transportation services and to establish contingency plans for providing the necessary shipping equipment (casks) and services in the unlikely event that commercial organizations are not able to meet the requirements on a timely basis. DOE PS at VI-7.

NECNP asserts that the prospect of having to unload a spent fuel pool on an emergency basis should be considered with respect to cask availability. NECNP PS at 105. In the unlikely event that a storage pool had to be unloaded on an emergency basis, the current fleet of casks could accomplish the transportation task in a timely manner. The maximum amount of spent fuel stored at any reactor basin in 1979 was 267 MTU at Dresden-2; the maximum amount stored off-site was at G.E.-Morris which currently has 350 MTU in storage (88). Emptying either of these pools, by transporting the fuel to storage pools which have the available space, and using the available cask fleet, would be limited only by the cask loading and unloading capacities of the affected storage pools. The number of casks that would have to be diverted from other uses would depend on the number of other required shipments (which at present are very few), the amount of fuel that would have to be moved, the distance the fuel would have to be moved, and the speed with which the desired removal operation should take place. Since the average loading of spent fuel storage pools of existing reactors amounts to about 90 MTU (88), the average emergency removal would require the diversion of only a portion of the existing cask fleet. The total yearly shipping capacity of the existing fleet is determined to be 511 MTU. DOE PS at VI-10.

II.D.2 Use of Railroads

The State of Wisconsin questions whether or not the allegedly declining role of railroads for transportation was taken into consideration when relying on rail transportation for 90 percent of the spent fuel shipments. WN PS, Mudrey at 11. During the 1955-1978 period, the revenue freight traffic of Class I railroads, measured in ton-miles, increased by about 38% (an average annual increase of a little over 1% per year). While the tonnage of revenue freight during this same period experienced no growth (actually a

decline of 0.5% for the entire period), the average freight train load per train increased by 49%, and the total train-miles declined by about 9% (89). Thus, the railroads have actually experienced a growth in business, although during the 1955-1978 period their share of the total freight ton-miles via all modes of transportation dropped from about 50% to 36%, while trucks have increased their share from about 19% to 25%, waterway shipments have held steady at about 16% of the market, and oil pipelines have increased their share from about 15% to 23% (90). Nonetheless, rail shipment still remains the dominant method of shipping freight in terms of ton-miles of shipments (89). In view of the continued growth in rail freight business and the fact that rail lines are relied on to carry the largest volume of freight of any transport mode, the Department submits that heavy reliance on the rail transport of spent fuel is justified.

This same Participant questions whether or not plans are underway to acquire rights-of-way between the repository and the nearest rail access, and whether or not there is a possibility of repository siting restrictions due to the absence of nearby rail access. WN PS, Mudrey at 11. It is entirely possible that some qualified sites might not have ready access to existing rail lines and that the necessary right-of-way would have to be acquired and a line installed to obtain such access. The cost of this effort would have to be included in the capital cost for the repository and incorporated into the disposal charge to the user. Moreover, this cost, and the environmental impact thereof, would have to be considered in the analysis associated with the selection of specific sites.

The Participant questioned whether or not the quality of the national railroad beds had been evaluated and noted that many sections of track have significantly reduced speeds imposed due to track problems; this Participant further questions whether or not a program is being developed for the preservation of specific rail routes from abandonment. WN PS, Mudrey at 11. The State of Wisconsin also questioned whether or not a program is being developed to upgrade specific rail lines in order to accommodate increased or heavier loads to meet safety standards, and whether the costs of revitalizing and rehabilitating the railroads would be accomplished through a Federal aid program or incorporated into a user charge to utilities. WN PS, Leverance at 3.

With respect to the quality of the national railroad beds, it should be noted that the average weight of a carload of freight in 1978 was 62.1 tons (91) and that the average carload of coal was 87.2 tons--with the larger cars holding 100 tons. Moreover, railroads routinely transport much heavier loads of machinery and equipment on rail cars equipped with a larger number of axles. Thus, the railroads on a national basis are readily capable of handling heavy loads (in excess of 100 tons) on a regular basis. Rail-type spent-fuel shipping casks typically weigh 100-125 tons and, therefore, do not represent an unusually heavy load for the national railroad system. In this respect, it should be noted that a typical 1,000-MWe coal-fired electric generating plant receives 30,000 carloads of coal annually containing 100 tons of coal each, compared with 7 cask shipments annually that would be required to transport the annual discharge of spent fuel from a nuclear generating station of the same capacity.

It is recognized that in some instances a railroad may reduce speed on a section of track that is in need of repair or upgrading until such work has been accomplished. This and other possible delays have been taken into consideration by the Department in its estimates of the number of casks required to effect the transport of spent fuel by assuming an average rail speed of 6 mph. DOE PS at VI-10. This is significantly below the 1978 average of 19.4 mph for all freight trains in the U.S. (92).

The possible need to preserve specific rail routes from abandonment has not been considered to date by the Department. This possibility can be addressed meaningfully only after specific sites have been selected for consideration. At the time of selecting sites from a group of qualified sites, consideration would have to be given to the likelihood of abandonment of the specific routes, the pro rata cost of preservation of such routes for spent fuel shipments and other shipments not related to repository operation, and the alternative routes that might be used and the differences in shipping costs associated with such use. These shipping route considerations, and the environmental impacts thereof, would have to be considered in an analysis of the costs and benefits associated with the selection of specific sites.

In view of the foregoing, the Department submits that shipment of the requisite quantities of spent fuel to AFR storage facilities and geologic repositories does not represent an unusual load for rail lines and beds

above that experienced for other commercial commodities and, therefore, should not require upgrading of the rail lines specifically for the transport of spent fuel. Any upgrading, revitalization, and rehabilitation that might be required by the railroads would be required for all traffic and would not be properly chargeable to spent fuel shipments alone. By way of illustration, more than 23 million carloads of freight were handled by the railroads in 1978, compared with a projected 1870 carloads of spent fuel projected to be sent to all repositories in 2003.

II.D.3 Quantity of Material Being Shipped

Two Participants voice concerns about the impact of transporting spent fuel to repositories in the quantities that the repositories would be designed to receive. One Participant states:

Present transportation capacity is 511 MTU/yr., consisting of the capability of 207 individual shipments by existing equipment. Scaling this times 12 to account for the 6,000 MTU/yr. projected for the 6th and ensuing years at the repository (p. VI-11), suggests 2,484 shipments/yr., or 10 shipments/day, or one every 45 minutes (daylight working day). These shipments are to be escorted, and will generally be traveling slowly. Depending upon the exact location and roadway, this shipment rate could affect local transportation, which is contrary to p. II-295.* WN PS, Mudrey at 10.

The number of individual shipments which the existing casks can handle annually, the method of extrapolation of the number of such shipments to the number that would be required to service a spent fuel repository, and the frequency of receipt of shipments at the repository, as described by Dr. Mudrey, are in error. While the capacity of existing licensed spent-fuel

*DOE PS at II-295 says:

The anticipated volume of materials moving to or from the site and the size of the daily work force are not expected to place excessive demands upon existing transportation systems.

shipping casks is estimated conservatively at 511 MTU/year, this does not represent a capacity for making only 207 individual shipments annually as suggested by the State of Wisconsin. One cask each of the six existing types of licensed casks would be capable of making a total of 207 shipments annually, but there are a total of 15 licensed casks available. These 15 licensed casks would be capable of making a total of 514 shipments per year and in doing so, would be capable of transporting 511 MTU/year from reactors to an AFR storage facility 1,000 miles away. DOE PS at VI-10. This is illustrated by Table II-D.

Table II-D. Annual Capacity of Existing Licensed Spent Nuclear Fuel Shipping Casks

Cask	Number of Shipments Per Year	Number of Casks Available	Total Number of Shipments	Average Capacity (MTU)	Total Yearly Shipping Capacity (MTU)
NLI 1/2 ^a	50	5	250	.42	105
NAC-1 ^a	50	3	150	.42	63
NFS-4 ^a	50	0	0	.42	0
TN-9 ^a	28	1	28	1.23	34
NLI-10/24 ^b	15	2	30	4.40	132
IF-300 ^b	14	4	56	3.16	177
Total		<u>15</u>	<u>514</u>		<u>511</u>

^a Truck casks.

^b Rail casks.

These data describing current cask availability do not represent the capacity that would be available for shipments to a repository site in 2003 (the sixth year of operation of the first repository) and should not be applied with a simple multiplication factor, for the following reasons:

1. Repositories will be designed to receive 90% of the spent fuel by rail and 10% by truck, whereas the existing licensed casks have a capacity for shipping 60% of the 511 MTU/yr total capacity by rail and 40% by truck for a distance of 1,000 miles. DOE PS at VI-10, VI-11.

2. It is projected that 53% of the spent fuel received by repositories in 2003 will be shipped a distance of 2,000 miles directly from the reactor to the repository, and 47% of the spent fuel will be shipped a distance of 1,000 miles from AFR storage to the repository. DOE PS at VI-12.
3. It is projected that all shipments from AFR storage to repositories will be accomplished by rail. DOE PS at VI-12.

It is projected that in 2003 about 4,600 MTU will need to be shipped from reactors to repositories and about 4,100 MTU will need to be shipped from AFR storage to repositories, giving a total of 8,700 MTU that would need to be shipped. DOE PS at VI-12. Assuming that 6,000 MTU would be shipped to the first repository from both reactors and AFR storage on a pro-rata basis as above; that 90% of the spent fuel shipped from reactors would be by rail and 10% would be by truck; and that 100% of the spent fuel shipped from AFR storage would be by rail, a total of 2,060 shipments would be required (1,290 shipments by rail, 770 shipments by truck), as follows:

From Reactors

$$(6,000 \text{ MTU}) \frac{(4.6)}{8.7} = 3,172 \text{ MTU}$$

2,855 MTU by Rail (90%)

$$\frac{952 \text{ MTU BWR fuel}}{(.176 \text{ MTU/assy})(24 \text{ assy/shipment})} = \underline{225} \text{ shipments (rail)}$$

$$\frac{1,903 \text{ MTU PWR fuel}}{(.45 \text{ MTU/assy})(10 \text{ assy/shipment})} = \underline{423} \text{ shipments (rail)}$$

317 MTU by truck (10%)

$$\frac{106 \text{ MTU BWR fuel}}{(.176 \text{ MTU/assy})(2 \text{ assy/shipment})} = \underline{301} \text{ shipments (truck)}$$

$$\frac{211 \text{ MTU PWR fuel}}{(.45 \text{ MTU/assy})(1 \text{ assy/shipment})} = \underline{469} \text{ shipments (truck)}$$

From AFR Storage

$$(6,000 \text{ MTU}) \left(\frac{4.1}{8.7} \right) = 2,828 \text{ MTU}$$

2,828 MTU by rail (100%)

$$\frac{943 \text{ MTU BWR fuel}}{(.176 \text{ MTU/assy}) (24 \text{ assy/shipment})} = \underline{223} \text{ shipments (rail)}$$

$$\frac{1,885 \text{ MTU PWR fuel}}{(.45 \text{ MTU/assy}) (10 \text{ assy/shipment})} = \underline{419} \text{ shipments (rail)}$$

The 2,060 shipments projected to be received at the first repository in 2003 in its sixth year of operation would amount to about 7 shipments/day on a 300-day year facility availability basis. This amounts to an average of 4.3 rail shipments/day (or about 1 every 6 hours) and 2.6 truck shipments/day (or about 1 every 9 hours). Repository operation including the receiving facilities associated therewith would be designed and complemented to receive spent fuel shipping casks on a 24-hour day, 7-day week basis.

From the foregoing, it can be seen that only about 37% of the shipments of spent fuel to the repository will be made by road. Regulations may require that shipments be escorted, but the presence of an escort should not slow the speed of the shipment. There are no provisions in the regulations of the Commission or the DOT which mandate a speed limit on vehicles used to transport spent fuel shipping casks below the legal limit established for all commercial vehicles. All current truck casks of U.S. manufacture are capable of being shipped as legal weight load; the truck shipping cask and vehicle do not constitute an oversize load. Therefore, there does not appear to be a basis for concluding that the shipments of spent-fuel into a repository by road will significantly affect local transportation.

One Participant raises a question concerning the increased costs for maintenance of roads, bridges, and highways (presumably resulting from damage believed likely to result from the fuel movements). MAD PS at 2. The Department has noted that spent-fuel shipments by truck are expected to conform to the same statutory load limits established for other commercial shipping. Thus, no special treatment need be required for spent-fuel shipments in respect to road use taxes, and no special considerations need be given spent fuel shipments in respect to their impact on road bed maintenance.

The State of Illinois alleges that the problems associated with regularly transporting large quantities of radioactive material from diverse points to a selected repository location has not been adequately addressed, if at all. IL PS, Roy at 3. The Participant has not defined which specific problems are of concern and should be addressed. However, the logistics and environmental impacts of regularly transporting large quantities of spent fuel have been addressed in a number of studies. These include:

1. A comprehensive review and analysis of the environmental effects of the transportation of spent fuel in a once through fuel cycle was reported by the Department in May 1979 (93). This review estimated the number of shipments (1,500-1,700 shipments/year in 2000) and analyzed, separately, the environmental effects of rail and truck transport of spent fuel, including consideration of:
 - (a) Resource commitments associated with the fabrication of equipment;
 - (b) Transport fuel requirements;
 - (c) Transport effluents;
 - (d) Physical, chemical and thermal effects;
 - (e) Radiological effects;
 - (f) Ecological effects;
 - (g) Environmental effects related to postulated accidents (radiological and non-radiological)

In addition to spent-fuel, this review and analysis also involved consideration of the environmental effects related to transporting radioactive wastes associated with light water reactor fuel reprocessing and fabrication.

2. A comprehensive review of the technology and economics of spent-fuel shipment (as well as the shipment of wastes resulting from reprocessing and recycle) was also reported by the Department in May 1979 (94).
3. A comprehensive review and analysis of the environmental effects of the transportation of

spent fuel in connection with the AFR storage thereof was reported by the Department in May 1980 (95).*

4. An analysis of the environmental impacts of the transportation of all radioactive materials associated with both a once-through fuel cycle economy and a recycle economy was reported by the Commission in 1976 (96). This analysis considered shipment volumes of 50,000 MTU over the period 1995-2000, as well as other shipments associated with reprocessing and recycle.
5. An analysis was made by the Commission in 1977 of the environmental impacts of the transportation of radioactive materials by all transportation modes, primarily from the standpoint of the effect such transport would have on radiation exposure under normal or accident conditions. The EIS includes a limited study of the conditions of transport, carrier controls, and routing (97).
6. A Transportation Technology Center was established at Sandia Laboratories by the Department for the purpose of:
 - (a) Development of transportation systems technology,
 - (b) Assuring that required transportation systems are identified to meet projected needs,
 - (c) Addressing and resolving institutional issues related to the transport of radioactive materials (including public concerns, regulations, interaction with other agencies, and the like), and
 - (d) Developing and maintaining an information center to accumulate information related to the transport of radioactive materials and to answer questions on transportation matters.

*By letter dated 10 June 1980, copies of that Final Environmental Impact Statement were filed with the Commission and served on each of the Participants in this proceeding.

From the foregoing, it should be clear that the subjects of volumes of radioactive materials, the requirements for shipping containers, and the prospective problems involved with the regular transport of the required amounts of spent fuel between reactors, AFR storage facilities, and geologic repositories have been, and are being fully addressed by the Department's program.

II.E ISSUES RELATED TO INTEGRATED OPERATION OF STORAGE AND DISPOSAL SYSTEMS

A number of Participants comment on various aspects of the integrated storage-disposal system that is under development. These comments fall in three general categories: (i) system integration analyses, (ii) encapsulation of spent fuel, and (iii) spent fuel storage locations. They are addressed in the following sections.

II.E.1 System Integration Analysis

Some Participants address various aspects of integrating the storage and disposal operations into an overall system. Two Participants note that no safety analysis has been prepared for the integrated operations. NECNP PS at 54; IL PS at 3. One Participant comments that the Department has failed to provide a detailed cost estimate of a comprehensive waste management program, and notes further that "the need for organizational refinement and superior personnel necessarily leads to a high cost program." NRDC PS at 81. Another Participant stresses the interactive nature of the component parts of an integrated spent-fuel management system and suggests that the system should be optimized in terms of costs and benefits. UNWGMG-EEI PS, Doc. 1 at 28. Three issues are raised in these comments: the first is an integrated safety analysis; the second is a detailed cost estimate on the integrated system; and the third is the optimization of the overall system.

The Department and the Commission both have conducted safety analyses and prepared environmental impact statements on the storage of spent fuel; DOE PS, Refs. V-9 to V-13, and (98); the Commission and the Department have formally evaluated and reported on the safety aspects of transportation

of radioactive materials, including spent fuel (98-102) (an issue outside the scope of this proceeding); and the Department is preparing a comprehensive evaluation of safety and environmental considerations related to alternative disposal concepts. DOE PS, Ref. III-34. (102, 103). The analyses of storage and disposal facilities include consideration of the operations involved in receiving and shipping spent-fuel casks. Given that interactions among these elements of the system would be most likely to occur at the shipping-receiving interfaces, and that these have been analyzed, the Department submits that no useful end would be served by any further integrated safety analysis.

Complete, site-specific safety analysis reports will be developed for each facility prior to its operation. DOE PS, Ref. IV-4. These safety analysis reports, for example, will include each of the interactive elements to the extent that that element bears on the operation of the specific facility. The environmental impact statement prepared for each facility will be separately issued and also will address the system including, such items as the number of shipments that are involved, routes, and other parts of the integrated system.

The Department recognizes that elements of the disposal and storage systems are highly interactive, i.e., repository availability, capacity, receiving rate, and deployment rate all have direct impacts on storage requirements. The relative locations of spent-fuel storage facilities and repositories influence transportation system considerations, including the number of casks required, shipping distances, and so forth, but do not impact in any way other than as the sum of the individual elements. The Department notes that the passage in the Department's Statement of Position, DOE PS at I-29,* cited by NECNP as indicating lack of an integrated system safety analysis, NECNP PS at 54, in fact referred to logistic and economic optimization, and not to safety considerations.

With respect to the second issue--that of a detailed cost estimate for the integrated operation--the Department notes that its Position Statement was not intended to provide a detailed cost estimate of the system.

*That passage says, ". . . studies to optimize the integrated system have not been completed."

Detailed cost estimates are being prepared as a part of the Department's development of the one-time charge for disposal or storage and disposal. The Department's preliminary estimate of July 1978; DOE PS, Ref. VI-5; is being updated and will reflect the added costs incurred in evaluating additional sites as recommended by the IRG and the President. See also Section II.A.14 of this Cross-Statement. The Department agrees with the need for organizational refinement and superior personnel mentioned by NRDC. NRDC PS at 81. However, the Department contends that even the costs associated with maintaining the superiority of required personnel will not cause the overall cost of the waste management program to be more than a small fraction of the cost of electricity delivered to the consumer, as previously discussed. DOE PS at VI-14.

The third issue, overall system optimization, was dealt with in the Department's initial Statement which is quoted in part as follows:

Current Department program effort consists of the development of a total waste management system optimized in terms of costs and benefits. Specific optimization studies will be performed in the near future. For illustrative purposes, assumptions can be made about the size, availability, and capacities of repository facilities and storage facilities. These assumptions allow the demonstration of the methods that are being used to develop an integrated spent fuel management system and the assessment of the capability of the system to meet needs for the timely storage, transportation, and disposal of spent fuel.

The discussion that follows includes a reasonable scenario of repository capacity and deployment, the away-from-reactor (AFR) storage requirements resulting from this scenario, the sensitivity of AFR storage requirements to changes in the schedule for repository deployment, the transportation requirements associated with AFR storage and repository operations, the capabilities for meeting these requirements, and a general assessment of the overall cost of the waste management systems. DOE PS at VI-1.

From the foregoing, it can be seen that the Department's development of the integrated system for storage and disposal is an ongoing process and that the methods used for that development assess all capabilities of the system to meet the needs of storage, transportation, and disposal in a manner that will optimize the system.

One Participant observes that an analysis of the relative costs and benefits of processing (i.e., encapsulating) spent fuel at various sites is missing from the Department's Position Statement. IL PS, Roy at 4. The Department has not considered the location of the encapsulation facility vis-a-vis the repository and AFR storage facilities, and does not intend to do so until specific repository and AFR storage sites have been identified and advanced in the selection process. The encapsulation facility could be located at an AFR storage site, a repository, or an independent site; location at a reactor is not being considered inasmuch as the cost of building and operating an encapsulation facility at each reactor site would be extremely high compared with the cost of a large encapsulation facility. The fact that such a cost and benefit analysis has not been conducted does not impact on the Department's confidence that it can locate, build, and operate an encapsulation facility at any of the locations as aforementioned, once the repository and AFR sites are selected.

This Participant also contends that the Department has not sufficiently addressed the problem of transport of encapsulated spent fuel. IL PS at 4. The principal disadvantage of locating the encapsulation facility away from the repository is the added cost of transportation. Spent-fuel shipping casks of existing designs with some modification could be used to ship encapsulated fuel from an encapsulation facility to a repository, if the two were not at the same location. For example, a modified NLI 10/24 cask could be used to transport 4 PWR or 8 BWR fuel assemblies; no modification to the cask would be necessary if the end fittings were removed from the spent fuel prior to encapsulation. Prior to the time a decision is made regarding the location of an encapsulation facility, the overall cost and benefits of alternative locations will be determined, including the cost of transportation associated therewith.

The Department submits that the issues related to encapsulation of the spent fuel, while important in the ultimate optimization of the storage/disposal system, do not affect any conclusions presented in its Statement of Position regarding confidence in the ability to store spent fuel for extended periods.

One Participant states that the use of AFR storage facilities should be discouraged inasmuch as they postpone the need for an ultimate disposal capability and dilute the effort to achieve a permanent resolution of the nuclear waste question. It recommends that regulations be revised to require new applicants to provide for indefinite AR storage for all spent fuel generated during the life of the plant. OH PS at 20-23. Another Participant states that on-site storage of spent fuel at reactor sites should be minimized and that regional AFR storage facilities should be utilized. OC PS at 16-18. A third Participant stated that on-site storage of spent fuel for no more than 13 years would minimize environmental impacts prior to disposal. DE PS at 6. A fourth Participant favored the providing of on-site capacity for storing its spent fuel at each plant for an indefinite period of time, but also states that the results of studies that it conducted indicated that there were no environmental considerations that precluded either AR or AFR storage. TVA PS at 4 and Attachment at 6.

The aforementioned positions represent a complete spectrum of location preferences for spent-fuel storage facilities--from storing all fuel at the reactor until disposal capability is available to maintaining only a minimum amount of spent fuel at the reactor and relying on AFR storage facilities for the centralized storage of spent fuel.

The Department's spent-fuel storage program is structured to provide AFR storage for spent fuel to the extent that storage capacity is not otherwise reasonably available to a utility company. As noted in its Statement of Position:

The Department has encouraged the utility companies to maximize the use of spent fuel storage facilities at nuclear power plants in order to minimize the amount of AFR storage capacity that will be needed. DOE PS at V-2.

The Department has a continuing program of surveying utility actions and status with respect to spent fuel storage and for estimating the likely needs for the AFR storage of spent fuel. As a result of this continuing analysis, the Department has observed both a trend of utilities to expand the capacity of their reactor pools as much as possible through reracking and

the uncertainty of the extent to which intra-utility shipments could be utilized. DOE PS at V-9. From the information collected from utility companies, the Department has estimated that 82-92% of the spent fuel will be stored at reactor storage facilities during the period 1987-1995; the remainder will have to be stored in AFR storage facilities. DOE PS, Fig. V-3.

The Department has concluded that, based on its analysis of safety and environmental considerations, water pool spent-fuel storage facilities, whether at-reactor or elsewhere, can be operated in a safe and environmentally acceptable manner. DOE PS at IV-26. While TVA prefers the use of at-reactor storage for its system based on operational and economic considerations, it also states that its studies and the environmental impact statements of the Department and Commission have concluded that the storage of spent fuel whether in a centralized facility or in on-site facilities, can be accomplished with minor environmental impact. TVA PS, App. A at 5. TVA further notes that the primary environmental differences between a centralized facility and individual on-site facilities would be the impacts of transporting spent fuel to a centralized facility, but states that TVA studies to date indicate there are no environmental considerations which would preclude either alternative. TVA PS, App. A at 6.

It is the policy of the Department that the cost of spent fuel storage in government AFR storage facilities would be fully recovered from users thereof. In his 12 February 1980 Message to Congress, DOE PS, App. A, the President stated:

All costs of storage, including the cost of locating, constructing and operating permanent geologic repositories, will be recovered through fees paid by utilities and other users of the services and will ultimately be borne by those who benefit from the activities generating the wastes.

The Department does not believe that the AFR program described in its Position Statement will significantly interfere with the orderly development of a spent fuel disposal system for the following reasons:

1. Water pool storage of spent fuel is an established technology and has been employed in the United States for more than 30 years on an operational basis. DOE PS at IV-9.

2. Research and development activities in connection with spent fuel storage are directed at (i) further developing alternative storage methods and (ii) further developing methods for monitoring fuel integrity during storage. DOE PS at IV-9 and IV-40. The former is directed at the development of less complex storage facilities, while the latter would be required even if no AFR storage were needed.
3. Research and development expenditures for FY-1981 for domestic spent fuel storage are budgeted at about \$16 million, compared with a budget of about \$219 million for the commercial waste management program(104).
4. A conceptual design of a 5000 MTHM capacity AFR storage facility has already been completed. DOE PS at IV-29. Work could commence on the final design of an AFR facility immediately after determination of capacity requirements and receipt of funding authorization.
5. The capital cost of a 5,000 MTHM AFR storage facility is estimated at \$250 million in 1978 dollars. DOE PS at V-26. The capacity equivalent of about two such facilities would be needed by 1995. DOE PS at V-8.
6. The Department's management and program organizations for the development of spent fuel storage facilities and the development of geologic repositories, though coordinated, are separate and do not involve the use of common staff or contractor personnel, except in limited instances. DOE PS at III-2 and V-7.
7. Storage of spent fuel in AFR storage facilities will be required regardless of whether spent fuel is subjected to disposal or reprocessing and, therefore, should not deleteriously impact the incentive for the timely development of a disposal capability. Indeed the availability of AFR storage capacity should ensure that repository development proceeds in an orderly and prudent fashion.

Along a somewhat different line than the previous comments, another Participant suggests remote siting for both storage and disposal facilities, with the same standards applied to each. OC PS at 10-12. The Depart-

ment does not agree that the same siting considerations apply to both storage and disposal facilities. The potential impacts of the two facilities are different, as is clear from the conclusions of the Commission's own environmental impact statements on spent fuel storage. DOE PS, Ref. IV-1.

In view of the facts that (i) spent-fuel storage can be accomplished in a safe and environmentally acceptable manner, either at reactor sites or at AFR storage facilities, (ii) the full cost of AFR storage will be recovered by the government, and (iii) the AFR storage program would not significantly detract from the orderly development of geologic repositories, the Department submits that there is no basis to mandate, by regulation or policy, that spent fuel should be stored at a particular location. Rather, the Department submits that a decision with regard to location of spent-fuel storage should be made on the basis of economics and logistics of operation within the framework of applicable regulations. While the Department is encouraging utility companies to maximize their on-site storage capability, it is expected that the Department's approach will provide the most cost-effective method of storage and will require a minimum of lead time. To the extent that additional storage capacity is required, it is the plan of the Department to provide such in the form of AFR storage on a full cost recovery basis.

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In its Statement of Position, the Department of Energy demonstrates that safe, environmentally acceptable storage and disposal facilities can and will be available when needed. The other Participants had an opportunity to challenge the bases for the Department's conclusion in their Statements of Position. After careful review of the Statements filed by the other Participants, the Department submits that, as shown in this Cross-Statement, none of the issues they raised provides a basis for a different conclusion.

III.A.1 Summary of Program Implementation Issues

Because issues of program implementation, sometimes referred to as "institutional or "nontechnical" issues, received particular emphasis by other Participants, they are discussed first, both in Part II of this Cross-Statement and in this chapter. The specific issues, grouped into categories for clarity, are summarized below, as are the reasons why the other Participants' Statements in no way refute the Department's position. Following these summaries are the Department's general conclusions about program implementation issues. The references in parentheses in the following discussion pertain to other portions of this Cross-Statement.

III.A.1.1 Coordination Within the Federal Government

The first category of issues pertains to the ability of various parts of the Federal Government, singly or together, to provide for waste storage or disposal. Some Participants question whether or not adequate cooperation can be achieved among all the levels of the Federal Government; i.e., whether the Federal Government will be able to pass necessary legislation (II.A.2), provide adequate funding (II.A.6), and coordinate activities of the various agencies (II.A.3). They also question the ability of the Department to manage the program to the extent necessary for its timely implementation (II.A.5).

The Department shows that in fact the Congress and the Executive Branch agree on the ultimate goal of the waste management program, although specific elements of a program designed to meet this goal are still

under consideration. The important point is that Congress and the Executive Branch are actively addressing the resolution of remaining issues and necessary legislation and continued provision of the program funds will be forthcoming. Furthermore, it is shown that the current program has been formulated with input from a broad range of institutions, demonstrating a national resolve to solve waste problems in a safe and environmentally acceptable manner and without further delay. It is unlikely that subsequent Administrations would make major changes to policies and programs thus established.

In both its Statement of Position and this Cross-Statement, the Department demonstrates that the activities of multiple Federal agencies are being coordinated through the direct leadership of the President and through formal coordination committees chaired by the Department of Energy. Other Participants do not substantiate their claims that adequate coordination is not now taking place or will not in the future.

The current lack of final regulatory standards for disposal is shown not to cause significant delay in the program by those Participants that have attempted to make such a delay an issue in this proceeding (II.A.7). The Department's R&D program is sufficiently broad-based and conservative to encompass the requirements of evolving disposal criteria. The Department demonstrates that its proposed performance objectives for disposal will not be inconsistent with any standards promulgated by the Commission or by the Environmental Protection Agency. Regulatory standards for storage already are in place.

With respect to the Department's capabilities, it is shown that the Department's present management structure is effective and reflects valuable lessons learned from the past.

III.A.1.2 Federal Cooperation With State and Local Governments

The second broad set of issues raised by other Participants concerns the ability of the Federal Government to secure necessary cooperation from State and local governments. In this connection, some Participants have questioned the intent of the Federal Government to give State and local governments a voice in the decisionmaking process (II.A.4.1), the availability and adequacy of mechanisms to incorporate state and local views (II.A.4.2), and the availability and adequacy of conflict resolution mechanisms (II.A.4.3).

The Department demonstrates that mechanisms to facilitate ongoing investigative work are in place, as evidenced by the fact that such work is proceeding at multiple locations throughout the nation. The still-undefined mechanisms largely concern the decisions as to which of several qualified specific sites should be proposed for location of a repository. The Department's program does not call for the first of these decisions to be made until 1985, and the Department has demonstrated that the current active participation by Congress, the Executive Branch, the State Planning Council, and various State governments should be able to define this process well before a specific repository site is proposed.

The Department also demonstrates that sufficient time has been allowed for addressing and resolving concerns that may be raised by State, Tribal, and local governments.

III. 1.3 Concerns of the Public

A third major category of program implementation issues concerns the Department's ability to address public concerns and thus win public confidence so that the waste program may go forward. Specific concerns raised include the Department's ability to address perceptions of risk (II.A.8), mitigate socioeconomic impacts (II.A.12), and achieve equity in distribution of risks and impacts (II.A.13).

The Department maintains that public perceptions of high risk will in time subside to match current scientific understanding and that public confidence will be gained through the Department's emphasis on safety, public education by credible public institutions, and the involvement of State and local officials at all phases of repository development.

The Department shows that it recognizes the importance of socioeconomic impacts and that it has instituted a program to assess them and to provide recommendations to Congress concerning methods of mitigation. The Federal Government has successfully dealt with such socioeconomic impacts at Federal installations of similar size. Furthermore, considerable time remains to allow the design of specific impact mitigation measures that might be required for radioactive waste repositories, because the earliest date forecast for the beginning of construction is 1991.

Some Participants also question the equity of imposing risks and impacts on people living near a repository or along transportation corridors and assert that perceived inequities could impede repository siting. The Department recognizes that the equity of the siting of undesirable but necessary facilities for handling noxious or hazardous materials (radioactive or otherwise) is a growing concern to modern society. The Department submits, however, that methods to deal with perceived inequities have been successfully applied for many types of facilities. The resolution of this concern will not require methods unique to radioactive waste management and will not lead to delay beyond the considerable time allowed in the Department's schedules.

III.A.1.4 Costs and Ability to Meet Schedules

A fourth major category of program implementation issues concerns the ability of the Department to meet its schedules for both disposal and storage. In particular, some Participants question whether industry will provide necessary cooperation (II.A.9), whether adequate time has been allowed for interaction with State and local governments and the public (II.A.10), whether the Department needs to more fully consider availability of multiple repositories (II.A.11), and whether the Department's Statement adequately treats storage and disposal costs (II.A.14).

The waste management program is proceeding with the active assistance of industry. The Department believes such industry cooperation will continue.

The Department demonstrates that its schedules for disposal do in fact provide considerable time for interaction with State and local governments, for public hearings, and for extended public interactions during both the site selection and repository licensing and development. Similarly, the schedules for away-from-reactor storage are shown to be reasonable. Finally, the Department maintains that the limited number (three to six) of repositories needed and the fact that these repositories will likely be located in scattered regions of the country, will not create problems greatly different in nature from those of a single repository and that the current program is structured to accommodate development of as many repositories as are needed.

The Department shows that it has considered all elements of waste management cost. This cost is shown to represent a relatively small proportion of electricity cost and is therefore not "prohibitive," the test the Commission has said it will apply in this proceeding in considering whether a waste disposal model is realistically available.

III.A.1.5 General Observations and Conclusions Concerning Program Implementation Issues

Some of the Participants attempt to use the foregoing specific "institutional" issues to support a logic for refuting the Department's conclusions. The general pattern used can be summarized as follows:

1. Such Participants contend that institutional issues are important. They cite past instances when program activities have been slowed or halted because of such problems as (i) intergovernmental conflict in the waste program; (ii) State and local opposition to repository siting; and (iii) public perceptions of exceedingly high repository risks. See, e.g., MN PS at 5, 6; NY PS at 70; NRDC PS at 6, 68; WN PS, Kelly at 4, 12; SE2-CN PS at 4; SHL PS at 2-3.
2. Such Participants contend either (i) that the Department has not adequately understood and addressed these issues; (ii) that the Department has no plans for dealing with these issues; or (iii) that such plans as the Department does have lack substance and specificity. See, e.g., OH PS at 4; MN PS at 8, 23; NECNP PS at 15, 31; NRDC PS at 5, 65; WN PS, Deese at 2; WN PS, Kelly at 1, 22; CEC PS at 37.
3. Such Participants contend that, at the very least, resolution of these issues will be time-consuming and that the Department has not made appropriate allowances in its schedules. See, e.g., OH PS at 11, 19; NECNP PS at 67, 68; NRDC PS at 65.

The Department agrees with other Participants that say that the resolution of difficult nontechnical problems is essential to the success of the waste program and that in many past instances the Federal Government has not adequately addressed these problems. In his Message of 12 February 1980,

the President stated that the resolution of nontechnical issues is at least as important as resolution of technical issues and recognized the prior inadequate involvement of State and local governments in the decisionmaking process for waste management activities. More recent events, however, not only show a clear recognition of these issues, but also provide examples of progress being made to address them. This evidence includes the actions of the President to formulate a national policy with broad input from multiple institutions and the public, the establishment of the State Planning Council, and numerous examples of joint Federal-State discussions and agreements. The Department does not contend that it now has "all the answers." Indeed, further study and consultation with others is an important part of the Department's plans. The Department has commissioned numerous studies of social, political, economic, and institutional problems in nuclear waste management; it has sponsored or facilitated numerous workshops, briefings of State and local officials, forums, public meetings, and conferences; and it has convened or participated in extended review groups and advisory groups composed of experts, elected officials, special interest groups, lay persons, etc. It is evident from the information represented in the Department's Statement of Position and this Cross-Statement that the results of these activities, as well as the Department's own experiences in working with States, localities, the public, and other Federal agencies, are being successfully incorporated into the program.

The Department maintains that it in fact has allotted sufficient time to provide solutions for the so-called "institutional" problems. Other Participants do not provide substantive information to support their claims to the contrary. Specific contingency times are set forth in the schedules in Chapter III.C of the Department's original Position Statement, and any specific contentions about these schedules are refuted in Section II.A.10 of this Cross-Statement. Although it is possible that resolution of these uncertainties will take longer than anticipated, the Department submits that its estimates are reasonable.

The question of whether or not the alleged lack of specificity or substance in particular institutional plans and mechanisms is a threat to program success bears closer examination. For example, it is true that the Department does not have detailed "institutional" plans to conduct site investigations over the next 5 years. Nonetheless, it does have written understandings with several of the States involved, and the fact remains that these

investigations are proceeding. Similarly, it is true that detailed plans have not been made for reaching siting decisions following the site exploration phases. But for such plans to be workable, they must be acceptable to the multiple institutions that must live by them. Accordingly, the important factor here is that these institutions be participants in their design. The Department submits that this is in fact now occurring. Through the efforts of the Department, the State Planning Council, individual State Governments, and Congress, consensus on the essential elements of the process is developing and is likely to be embodied in legislation soon. It thus is appropriate that only a framework for consultation and concurrence exists at this time.

Perhaps the best assurance that these issues of program implementation will be resolved in a timely fashion lies in the will of the American people. It should be clear by now that American society views the problem of nuclear waste as a serious piece of unfinished environmental business that must be resolved without further delay. The public will thus hold its institutions accountable for expeditious, good-faith efforts to resolve their differences. Interagency disputes can, if necessary, be appealed to Presidents or Governors. Intergovernmental disputes will yield either to negotiated resolution or to powers of law prescribed by the United States Constitution and exercised by the Congress. In short, the willingness and determination of citizens and voters that progress be made toward reasonable, equitable, and safe solutions creates confidence that nontechnical problems can and will be overcome. As part of this proceeding, the Commission will independently evaluate the technical capability of the national program to provide nuclear waste isolation that will protect the health and safety of the public. If the Commission publicly expresses confidence in this technical capability, many of the problems of program implementation stand to be greatly lessened.

III.A.2 Summary of Technical Issues Related to Disposal

As seen in Chapter II.B of this Cross-Statement, many Participants raise issues relative to the technical basis for the Department's waste disposal program. Most of these Participants contend that uncertainties in the current scientific bases cast doubt on the overall feasibility of deep geologic disposal. Some simply contend that these uncertainties cannot be

resolved within allowed time frames. Each of the issues raised pertains either to the times required for containment and isolation, performance assessment capabilities, one of the disposal system components (waste package, repository, or site) or alternative disposal methods. In this Cross-Statement, the Department examines these issues in one of such contexts. Also, considering that a large number of these issues ultimately pertain to the degree of reliance the Department places on possible scientific breakthroughs and the significance of ongoing research, this has been treated as a separate category and has received particular emphasis. Following summary discussions of issues raised in each of these categories, the Department presents its overall conclusions about the disposal program.

III.A.2.1 Period of Time for Which There Should be Reasonable Assurance of Waste Containment and Isolation

Several Participants challenge the Department's position relative to the times required for waste "containment" and "isolation" (II.B.1). The underlying thrusts of their allegations are that (i) the Department's proposed objectives do not coincide with draft NRC criteria, (ii) the Department's numerical objectives are without basis, and (iii) postulated long-term releases warrant longer periods of control. After elaborating on the basis for its proposed containment and isolation objectives, the Department shows that its containment objective is consistent with the intent of NRC Staff criteria, and that some Participants' assertions that the required isolation period should be longer do not properly consider the hazard that the waste will actually represent over this longer time period.

III.A.2.2 Degree of Reliance on Possible Scientific Breakthroughs and Significance of Ongoing Research

A number of Participants contend that the Department's disposal program places undue reliance on scientific breakthroughs and ongoing research (II.B.2). Such Participants base their presentations largely on quotations from various documents that identify claimed research needs and technical uncertainties. The Department demonstrates in its Statement of Position and

in this Cross-Statement that scientific breakthroughs are not required to successfully implement geologic disposal; that, because of the existing depth of technical knowledge, program diversity, and flexibility, undue reliance is not placed on research efforts; and that the conservative approach described in its Position Statement will in fact lead to the safe disposal of radioactive waste despite residual uncertainties that will always remain. The Department's position is shown to be strongly supported by several other Participants in this proceeding and by the Interagency Review Group on Nuclear Waste Management. Arguments to the contrary are shown to be based on incorrect interpretations or misunderstandings of the Department's conservative approach.

III.A.2.3 Performance Assessment

Several Participants assert that methods for assessing the performance of mined geologic disposal systems are inadequately developed to establish confidence (II.B.3). They appear to believe that no assessments can be made unless all details of every process can be accounted for and that every physical and chemical phenomenon must be completely understood, regardless of its significance. The Department asserts, as do several other Participants, that scientists can in fact apply scientific judgment and analytical techniques to identify those phenomena that are truly significant; and, by using conservative values of input data, scientists can establish an upper bound on the effects of phenomena not completely understood. The use in current analytical models of extremely conservative assumptions for leach rates, radionuclide sorption, modes and rates of radionuclide migrations, and probability determinations of geologic events has indicated that mined geologic disposal will limit consequences to levels that will be acceptable in terms of both human impact and environmental consequence.

III.A.2.4 Waste Package

Several Participants assert that the interactions of wastes and potential host rocks are not sufficiently understood to reach a finding of confidence (II.B.4). The Department refers to conclusions in its Position Statement and supporting references containing a large body of information on thermal and radiation effects on various geologic media, and on waste package

interactions to counter this suggestion. Contrary to many assertions, data on the performance of spent fuel in geologic environments is being developed. There are in fact, many bodies of data pertinent to the performance of waste package components (e.g., canister materials and backfill materials) under repository conditions. The Department submits that sufficient information is available to recognize the benefits of engineered barriers and to acknowledge their feasibility. Moreover, Participants' assertions that knowledge of waste package performance is inadequate do not consider waste package and repository design alternatives that can be tailored to provide a conservatively designed system that will incorporate the natural features of a specific site. They also fail to recognize here, as elsewhere in their arguments, that the impacts of many individual processes that might affect waste packages can likewise be conservatively bounded in assessments of system performance and through the use of design and operating margins.

III.A.2.5 Repository Performance

Major contentions raised by Participants relative to repository performance are that thermal effects are not adequately understood (II.B.5.1); borehole, shaft, and backfill technology is not adequately developed (II.B.5.2); retrieval is not properly addressed and may not be possible in some media (II.B.5.3); abandoned sites may not be adequately restored (II.B.5.4); operational and post-closure monitoring are not adequately addressed (II.B.5.5); and potential human intrusion may disqualify many geologic disposal sites (II.B.5.6). The Department shows that many such allegations do not account for technical progress in recent years, ignore much of the information set forth in the Department's Statement, and misinterpret technical documents they themselves have referenced. All other issues raised are demonstrated to be adequately addressed in the Department's Statement of Position.

III.A.2.6 Site Characterization

Several Participants assert that the geosciences are not sufficiently advanced to identify an acceptable medium or specific site for mined geologic disposal (II.B.6). To counter these assertions, the Department describes (i) the opinions of many eminent scientific peer review groups, (ii)

the body of information on geologic exploration techniques, (iii) the Department's research on waste/rock interactions, (iv) the very stability and integrity of many geologic formations, and (v) the methods and associated results for performance assessments performed in concert with the siting process. Geologic processes are shown to indeed lend themselves to scientific evaluation. Furthermore, it is possible to bound the effects of potential phenomena over long periods of time, so perfect knowledge of every process is not required to make decisions about site suitability. Suggestions by some Participants that required technology, such as hydrologic testing and modeling, are not well advanced are answered by pointing out availability of many working, sophisticated models. Further, it is shown that contentions regarding the viability of each of the media under current investigation ignore existing information and focus instead on minor resolvable issues. Sweeping generalizations about the unacceptability of a specific medium are shown not to be based on substantive information.

III.A.2.7 Alternative Disposal Methods

Some Participants contend that the Department has not provided an adequate evaluation to allow the rejection of alternatives to deep geologic disposal (II.B.7). The Department describes, in detail, the overall program strategy in compliance with NEPA and points out that the selection of geologic disposal is an interim planning strategy to be reviewed upon forthcoming issuance of its Final Environmental Impact Statement on the Management of Commercially Generated Radioactive Waste.

III.A.2.8 General Observations and Conclusions on Technical Issues Related to Disposal

The Department wishes to present some general observations with respect to various Participants' assertions as to the overall feasibility of deep geologic disposal. First, the Department notes that Participants have raised no new issues--each of the technical issues raised has been addressed in the Department's Statement of Position or is being addressed by current research. Second, many of the allegations made are either irrelevant or do not recognize the extensive body of work that has been undertaken over the

last several years. Third, many of the Participants have emphasized how much is unknown without explaining why they believe these uncertainties are of particular significance.

On the other hand, the Department and others as indicated herein have provided ample evidence that through ongoing research and the use of a conservative approach, residual uncertainties and "gaps" in knowledge can be bounded. In addition, the significance of any uncertainties with respect to specific barriers will be limited because of the fact that no one barrier is critical to isolation or containment. Furthermore, the Department's conclusions with respect to overall feasibility do not rely on scientific breakthroughs or place undue reliance on the outcome of any of its R&D programs. The Department has laid out comprehensive proposed performance objectives by which a waste management system can be judged and asserts that compliance with those objectives, coupled with the diversity and flexibility inherent in its program, provides confidence that all relevant regulatory and statutory requirements will be met.

The Department also notes agreement on this issue of overall feasibility by at least one Participant that nonetheless challenges the Department's summary position. Participant National Resources Defense Council states:

The simple question of whether wastes "can" be disposed of safely is not at issue. No informed commentator has claimed that it is now and will continue to be impossible to isolate or contain high-level radioactive wastes. No laws of physics must be violated to produce a waste disposal program. Theoretically, therefore, waste containment and isolation are feasible. The demand placed on DOE and the NRC is not to show that isolation can be achieved, but that it both can and will be achieved, within the requisite time period. NRDC PS at 9.

In short, the Commission should dismiss as an issue the question of whether there now exists a sufficient scientific and technical basis for developing safe, environmentally acceptable facilities for waste disposal. Ample evidence to further support this is provided in the Department's Statement of Position and is backed by the Statements of many other Participants in this proceeding: AEG PS, AIChE PS, AIF PS, ANS PS, Bech PS, CPC PS, GE PS, NFE PS, SE2-CN PS, UNWGMG-EEI PS, USGS PS.

As indicated before, aside from the general issue just discussed, some Participants question whether these technical issues can be resolved to the extent necessary within the estimated time frames. The Department discusses this in its Statement of Position by listing technology development as one of the eight significant factors that can influence the timing and schedule of a repository. DOE PS at I-23. Specific milestones for technology development activities to support the waste package, repository engineering, and site selection are presented. DOE PS at III-65 to III-68. None of the Participants challenges these specific milestones. Rather, their positions appear to be general judgments that certain technical issues or uncertainties will not be sufficiently resolved or narrowed in time to support the Department's schedules.

In summary, the Department concludes that the Statements of Position filed by other Participants provide no technical basis for altering its conclusions that safe, environmentally acceptable disposal facilities will be available when needed.

III.A.3 Summary of Technical Issues Related to Storage, Transportation Logistics, and the Integration of Storage and Disposal Systems

The Statements of Position filed by some other Participants raise issues concerning technical aspects of spent-fuel storage, transportation logistics, and the integrated operation of storage and disposal systems. The Department has examined each of the issues raised in these categories and submits that none of the Participants provides a basis for altering the Department's position that safe, environmentally acceptable storage facilities and an adequate integrated storage and disposal system, including the transportation system necessary thereto, will be available when needed. A summary discussion of issues raised by other Participants and addressed in this Cross-Statement follows.

III.A.3.1 Spent-Fuel Storage

Concerns are expressed by a few Participants regarding the technical basis for confidence in safe, environmentally acceptable extended

storage. In addition to general reservations (II.C.1), some Participants raise issues regarding the integrity and longevity of spent fuel in a storage environment (II.C.2) and of storage pool components (II.C.3).

The Department demonstrates that the concerns expressed by these Participants are unfounded. There is extensive experience (about 20 years) with the safe, environmentally acceptable interim storage of spent nuclear fuel. Storage pool design and the spent fuel itself incorporate multiple barriers to the release of radioactivity into the environment. The Department also demonstrates that spent fuel pools were designed to function continuously over the 40-year economic life of a nuclear power plant.

In this Cross-Statement, the Department shows that, though the inventory of high burnup spent fuel is presently small, experience has revealed no evidence of any burnup-related degradation mechanism. A continuing program is in place to increase the Department's data-base in the storage of such fuel. The Department also provides ample evidence that water reactor fuel is resistant to degradation during pool storage.

Pool component degradation is shown to be a minimal problem. In the relatively few cases of equipment failure, pool operators have been able promptly to replace the equipment or component. Extensive experience with pool operation has demonstrated the ability of storage pool components to withstand the storage pool operating environment.

Two Participants allege that past events at storage pools or the required human management of storage pools demonstrate a potential for future accidents (II.C.4 and II.C.5). The Department demonstrates that the possibility of a major accident with off-site consequences is remote because of the characteristics of the spent fuel itself, the benign nature of water pool storage and the lack of internal driving forces for such a dispersal of radioactive material. The Department concludes that there is a technically sound basis for confidence that safe and environmentally acceptable storage of spent nuclear fuel can be continued for an extended period of time either on-site or off-site.

III.A.3.2 Transportation Logistics

Some Participants express concerns related to the logistics of transporting spent fuel, including (i) the possibility that there will be an

insufficient number of casks available to meet transport needs (II.D.1); (ii) the fact that railroads are being depended on for the bulk of the shipments (II.D.2); and (iii) the impact of the large number of shipments on local communities and receiving facilities (II.D.3). The Department shows that the requirements for shipping casks will most easily be filled with present casks and a modest program of cask construction readily within existing industrial capability. It is also demonstrated that the Nation's railroads can meet the program's transportation needs and that the number of shipments is not expected to be so large as to have a significant impact in local communities. The Department submits that receiving facilities can be designed to accommodate the expected shipments.

III.A.3.3 Integrated Operation of Storage and Disposal Systems

In response to some Participants' assertions that an integrated safety analysis is required (II.E.1), the Department shows that (i) both the Department and the Commission have in fact conducted safety analyses and environmental impact analyses on the storage of spent fuel; (ii) the Department and the Commission have evaluated and reported on the safety aspects of transporting spent fuel (a topic outside the scope of this proceeding); and (iii) the Department is preparing a comprehensive evaluation of safety and environmental considerations related to disposal. The interactions among these three elements already have been analyzed at the shipping-receiving interface, thereby providing a complete analysis of each component part of the system.

Regarding assertions that a cost estimate for the integrated system is needed (II.E.1), the Department notes that the Commission has stated specifically that this proceeding is not intended to examine a detailed cost estimate. However, detailed cost estimates are being prepared as a part of the Department's development of the one-time charge for disposal or storage and disposal.

One Participant cites the absence of discussion of the logistics of encapsulation of spent fuel as a deficiency in the Department's Position Statement (II.E.2). The Department submits that the issues related to location of an encapsulation facility do not affect any conclusions that it has presented regarding confidence in the ability to store spent fuel for

extended periods and disposal of such fuel in a safe and environmentally acceptable manner.

A wide range of views is presented in comments on the issue of location of storage facilities (II.E.3). The Department submits that its spent-fuel storage program is structured to provide, on the basis of full cost recovery, AFR storage capability to the extent that such storage capability is not otherwise available to a utility. The Department demonstrates that water pool storage can be operated in a safe and environmentally acceptable manner, whether at a reactor or elsewhere. A number of other Participants have supported this conclusion, based on their own experience. The Department submits that a decision with regard to the location of spent fuel storage should be made on the basis of economics and logistics of operation within the framework of applicable regulations.

III.A.4 Conclusions

Based upon the foregoing Cross-Statement, the Department of Energy reiterates that the Nuclear Regulatory Commission must find that it has confidence that:

1. Spent nuclear fuel from licensed facilities can be disposed of in a safe and environmentally acceptable manner;
2. The Federal Government's plans for establishing geologic repositories are an effective and reasonable means for developing a safe and environmentally acceptable disposal system;
3. Spent nuclear fuel from licensed facilities can be stored in a safe and environmentally acceptable manner on-site or off-site until disposal facilities are available;
4. Sufficient additional storage capacity for spent nuclear fuel from licensed facilities will be established; and
5. The disposal and interim storage systems for spent nuclear fuel from licensed facilities will be integrated into an acceptable operating system.

III.B RECOMMENDATIONS AS TO HOW SAFETY AND ENVIRONMENTAL IMPLICATIONS OF SPENT NUCLEAR FUEL MANAGEMENT SHOULD BE HANDLED IN INDIVIDUAL NRC FACILITY LICENSING PROCEEDINGS

Having made the findings recommended above by the Department, III.A.4, the Commission should promulgate a rule providing that the safety and environmental implications of spent nuclear fuel remaining on site after the anticipated expiration of the facility licenses involved need not be considered in individual facility licensing proceedings. Contrary suggestions by some other Participants should be rejected.

Some Participants are using this proceeding as a forum for arguing that a moratorium should be placed upon the issuance of construction permits for new nuclear power plants because of the state of the waste management program. See, e.g., CEC PS at ii; NY PS at 115-116; SHL PS at 1, 6-7. Even if this proceeding were an appropriate forum for considering a moratorium, the record herein does not support such a decision. On the contrary and as demonstrated by the Department in its Statement of Position and this Cross-Statement, a program for implementing an adequate, safe, and environmentally acceptable overall waste management system now exists. It therefore follows that there is no basis for a moratorium on construction permits for new nuclear power plants, which would not even begin to produce spent fuel for a number of years until after construction and start-up. A moratorium based on the record of this proceeding alone would violate the program established by Congress to encourage widespread participation in the development and utilization of atomic energy for peaceful purposes to the maximum extent consistent with the common defense and security and with the health and safety of the public. See Section 3 of the Atomic Energy Act of 1954, as amended; 42 U.S.C. 2013.

One Participant, while not calling for a moratorium, suggests that licensing of both AFR storage facilities and new reactors might be made contingent on meeting specific deadlines in the program. WN PS, Deese at 8-9. Such an approach is unnecessary and could in fact be counterproductive in that decisions might be made prematurely in the face of artificial deadlines which threaten a greater harm to the National interest. The program for establishing mined geologic repositories, as described by the Department; DOF PS, Part III; focuses on developing repositories that will be available in an

appropriate time frame. The durations of each activity leading to the operation of a geologic repository have been estimated using information from specialists most directly involved with each activity. For example, the period of time required for the NRC regulatory review was based upon information provided by the Commission Staff. DOE PS at III-35. Evaluation of logistic and administrative factors shows that, with proper planning, schedule slippage can be minimized. On the basis of its estimates, the Department has shown that the range of possible dates for operational start-up of the first geologic repository is 1997-2006. See DOE PS, Figs. III-2, III-3. See also II.A.10, supra. Because this range of dates is already conservatively calculated, there is no need at this time to impose interim deadlines. If, at some future time, grounds can be shown for establishing interim deadlines, the Commission can reconsider its decision.

Another suggestion is that the Commission should revise its regulations to require each new applicant to provide for indefinite at-reactor storage for all spent fuel generated over the life of the plant. OH PS at 23. Although the Department has encouraged electric utilities to maximize their on-site storage capacities to allow for flexibility, such indefinite at-reactor storage will not be required. Disposal facilities will be available when spent fuel is discharged from power plants for which a construction permit has not even been granted.

A further recommendation is that a finding of confidence be delayed until certain additional work is completed. MECNP PS at 77-78. A delay is unnecessary and would be contrary to the public interest, because the Commission can make a finding of confidence based on the material already in the record of this rulemaking. A prompt finding of confidence would allay public concerns about nuclear waste disposal and storage and would be a substantial contribution to the amelioration of the program implementation issues discussed elsewhere in this Cross-Statement. See II.A., supra.

The Department said in its Statement of Position that, at the conclusion of this proceeding, the Commission should promulgate a rule providing that the safety and environmental implications of spent nuclear fuel remaining on site after the anticipated expiration of the facility licenses involved need not be considered in individual facility licensing proceedings. DOE PS at VII-1. Other Participants have made essentially the same recommen-

dition. See, e.g., UNWVG-EEI PS, Doc. 1 at 4; GE PS at 3; ANS PS at 35; AIF PS at 47. This recommendation is supported by the overwhelming body of information presented by the Department and others about the technical bases and programs for establishing and integrating disposal and storage systems. See II.E., supra. The Statements of Position submitted by other Participants have not shown, as discussed in this Cross-Statement, that disposal and storage facilities can not and will not be made available when needed.

The Department's presentation of the mined geologic repository program and the AFR storage program demonstrates that there exists an overall waste management program capable of handling, storing, and disposing of spent fuel from commercial power reactors. The Commission should concur in this finding and determine that the issue need not be considered in individual NRC licensing proceedings. Requiring that this issue be considered in individual proceedings would be duplicative of this proceeding and an inefficient use of the resources of the Commission and others involved in NRC proceedings.

APPENDIX A
RESPONSES TO SPECIFIC SHORT QUESTIONS

Several Participants have provided specific short statements or questions about particular passages in the Department of Energy's Statement of Position that are best addressed in a question-and-response format, as presented below. The references following the statement or question are to the Participant's Statement of Position. The commenter's citations are to the Department's Position Statement.

- Q. P. II-59-61, liters total or liters per what? WN PS, Mudrey at 12.
- R. The fluid influx described represents the total quantity accumulated over a specified period of time. See DOE PS at 11-59 (indicating "Under these assumptions, . . . the total accumulated influx of brine 1,500 years after emplacement is about 6 liters.")
- Q. P. II-364, references No. 760 and 761. My copy of DOE/TIC-11033 (Draft), April 1980, does not contain these pages nor does it contain these reference. WN PS, Mudrey at 12.
- R. Since DOE PS, Ref. II-760, is not DOE/TIC-11033, the Department assumes the questioner means DOE PS, Refs. II-761 and II-762. The correct page numbers are D96 and D97, respectively.
- Q. P. II-339, reference no. 431. My copy does not contain this section nor page number. WN PS, Mudrey at 12.
- R. The correct reference is page number 3.1.34.
- Q. P. II-169, last sentence. Reference 28 makes no sense in this context. WN PS, Mudrey at 12.
- R. The correct reference is DOE PS, Ref. II-447.

p. II-141, last complete paragraph beginning "Preliminary" The question is not whether or not spent fuel is a durable waste form, but whether or not the material that is leached can be retained, and if not, whether or not there is high toxicity. At least one paper (DOE reference no. 333) reports 100 percent of Cesium being leached (Table 1 of cited report). WN PS, Mudrey at 12.

See II.B.4.1-II.B.4.3. of this Cross-Statement.

P. II-146, Carbon. A body of data suggests that plutonium and possibly other nuclides are mobilized in organic system, arguing very strongly that no carbon-based materials should become involved with the waste (DOE reference no. 249, p. 155-ff). WN PS, Mudrey at 12.

In its Statement, the Department notes that the chemical inertness and high temperature stability of various carbon forms may make it an attractive barrier candidate material for canister, overpack, or sleeve construction. DOE PS at II-146. The relevance of the fact that carbon is a basic constituent of organic systems to the element's use as a radionuclide transport barrier is not clear. If carbon proves to be an acceptable barrier material, the potential radiological hazard associated with its use would be minimal, especially in view of its use as a part of the disposal system that is the most remote from the accessible environment. Carbon, because of its potentially excellent characteristics, should continue to be considered as candidate barrier material.

P. II-300, item 4. Even if characteristics are identified, can we adequately quantify and predict responses? See particularly discussion of p. II-240. We concur that the successful disposal system can be summarized and characterized, but can such characterization be adequately quantified so as to predict

response to designed and accidental actions? WN PS, Mudrey at 13.

R. Section II.B.3 of this Cross-Statement addresses technical issues related to performance assessment. The Department's Position Statement, following the cited statement, contains several cross-references to other parts of the DOE Statement that amplify on the subject. DOE PS at II-300 to II-305. On the basis of the technical work cited in its Position Statement, the Department contends that such characterization will be adequately quantified at the time of repository licensing.

Q. P. II-302, item 4.4. This statement clearly says that waste packages do not presently exist, thus making many, if not most, of the engineering and geotechnical discussions less firm than this document purports. WN PS, Mudrey at 13.

R. As noted elsewhere in the Department's Position Statement, the actual design of a waste package system is specific to a repository site. DOE PS at II-150. Nevertheless, studies conducted to date indicate that appropriate packages can be designed and fabricated for the four geologic media presently under consideration. DOE PS at II-152. Certain components of the waste package would not be required in all media. It should be noted that engineering and geotechnical considerations are, in themselves, primary determinants of package design. While it is thus possible to develop generic package designs, it would not be scientifically sound, in the best interests of the public health and safety, or fiscally responsible to proceed with specific package designs, of the type that will be required for licensing, until detailed geochemical and other characteristics of specific sites are identified. However, the Department maintains that the technology to prepare site-specific designs is readily available.

- Q. Page I-20-What is meant by "proposed specific proposed performance objectives"? WN PS, Leverance at 1.
- R. The term "Proposed specific proposed performance objectives" as given, DOE PS at I-20, is incorrect and should read "Program performance objectives." Discussion of the objectives is found in the DOE PS at II-7.
- Q. Page I-21, #4 - Please describe what no unreasonable environmental impact means. This statement is presumptive. Utilized as a conclusionary statement prior to accumulation of facts and data supporting its basis renders it useless. The entire process documenting the method of disposal through the appropriate regulatory procedures should be the method utilized in allowing the decisionmakers to arrive at this conclusion. WN PS, Leverance at 1.
- R. For the convenience of the reader, the Department included in its Position Statement a detailed introduction specifying its position and summarizing subsequent portions of the document. DOE PS, Part I. The basis for the statement relative to environmental impacts is at DOE PS at II-286 to II-297. The Department's position continues to be that the environmental impacts of repository development are not out of the ordinary for a major construction project and that the probability of release of radioactive material is so low that environmental impacts are negligible. The Department recognizes the need to operate within the procedural bounds imposed by the National Environmental Policy Act and the regulatory framework. A discussion of the Department's planned NEPA and regulatory compliance program is presented in its statement. DOE PS, Section III.D.1.
- Q. Page I-23 - Within this listing of significant factors that could influence the timing and schedule of a repository are probable legal challenges by private, local or state parties. WN PS, Leverance at 1.

- R. II.A.10 of this Cross-Statement addresses these potential impacts on the schedule.
- Q. Page II-18, Objective 6 - Within the discussion it is stated that a reliance cannot be placed on scientific breakthroughs. To completely discount any future and possibly better methods of disposal or neutralization, especially when considering the time frames being proposed, would defeat the waste management purpose of safe and environmentally acceptable nuclear waste disposal. WN PS, Leverage at 1.
- R. The Department's Position Statement says that, in accord with IRG recommendations, the burden for management of radioactive wastes shall not be placed on future generations. DOE PS at II-8. The thrust of the current proceeding is not whether improved disposal methods may evolve, but to make a finding that current technology will provide reasonable assurance that wastes can be safely disposed of. DOE PS at I-1 and II-298. At no point in the Department's Statement is an attempt made to discount future advances in the technology. The Department's position remains that application of currently available technology, and those advances which will result from ongoing R&D in the near term, will adequately assure a public health and safety finding in this proceeding. Future advances are not arbitrarily excluded at any point in the Department's Statement, and, indeed, work is continuing in a number of such areas. Areas in which such work is continuing are identified throughout Part II of the Department's Position Statement.
- Q. Page II-279, first paragraph - The calculated dose is expressed for receptors residing at a position 3 1/2 miles from the release point. What would the controlling dose be to workers at the release point assuming these same accident conditions? The next paragraph does list dose limits for specific organs for on-site workers as suggested by the International Commission on Radiological Protection. WN PS, Leverage at 1.

R. Calculation of doses to workers at the point of a release is dependent on a number of factors that are site-dependent, specifically including design features and procedural controls. However, for the waste hoist failure discussed at DOE PS II-279, a conservative extrapolation of worker exposure is possible based on the following assumptions:

1. The radiation worker is located 100 meters from the surface discharge point.
2. Prevailing meteorological conditions are Class A and 4.2 m/s wind velocity, which represent a conservative condition.
3. Exposure pathways include inhalation and immersion.
4. The exposure period is not limited even though exposure time would be limited by procedural controls.

For the conditions noted above, the controlling dose commitment of the involved worker may be conservatively estimated as 5.5×10^{-4} rem (bone) and 8.7×10^{-3} (lung) for the case with functional HEPA filtration. Equivalent doses for the case without HEPA filtration are 4.4 rem (bone) and 3.2 rem (lung). In both of the above cases, the estimated doses are well within International Commission on Radiological Protection guidelines.

Q. Page II-280, II.F.3.5., Waste Emplacement and Retrieval Considerations - This section should consider a "worst case" scenario. Reliance on a second repository would be impossible if the first repository would entail or suffer engineering problems prior to the second repository's completion. Broad contingency plans need to be developed in order that an established procedure can be implemented to deal with potentially hazardous situations. WN PS, Leverance at 1.

R. See Section II.B.5.3 of this Cross-Statement.

Q. Page II-295, II.F.4.3.8., Transportation Impacts, last sentence--The transportation impacts for both site construction and operation could be very large dependent on repository location. WN PS, Leverance at 1.

R. See Chapter II.D of this Cross-Statement.

Q. Discussion of impacts within this document highlight the more "favorable" impacts of repository construction. I believe an objective discussion should address impacts, both pro and con, and their relationship to the project. WN PS, Leverance at 2.

R. The purpose of the Department of Energy Position Statement was to address the issues within the scope of this proceeding, not to be a detailed environmental impact statement (EIS). Characterization of generic environmental impacts were summarized based on the Draft Environmental Impact Statement for Management of Commercially Generated Radioactive Waste, which examines these impacts in much more detail. DOE PS, Ref. II-38. Impacts at a particular site will be assessed in the EIS's to be issued relative to that site. See DOE PS at III-40 to III-41.

Q. Page II-296, II.F.4.3.9., Socioeconomic and Institutional Impacts, second paragraph - While some proposed repository sites may not experience unmanageable levels of growth, others will need careful planning. Repository location will undoubtedly favor more rural areas in order to avoid large population centers; therefore, these impacts may be far greater than is indicated here.

A repository in a rural area near small population centers could result in the "boom-bust" situation that occurred with many short-term mining operations. These local economies experienced rapid growth and expansion during development but suffered severe economic reversal upon mining closure. Thus,

dependent on location, a repository could significantly impact certain rural areas. These impacts should be considered. WN PS, Leverance at 2.

R. See Section II.A.12 of this Cross-Statement.

Q. Page II-296, II.F.4.4., Environmental Summary, first paragraph--It is stated "land use and water use are site specific, but the amounts required are small in terms of environmental impacts. A repository will pose non-radiological impacts similar to those encountered in a sizeable deep-mine type of complex."

The impacts in all major environmental areas - water quality, air quality, land use, etc., are potentially very great. This proposed development wherever it occurs is a major mining operation with significant surface and subsurface physical facilities. In no respect should it be considered as insignificant as the above statements would lead one to believe. WN PS, Leverance at 2.

R. In its Statement of Position, the Department recognized that the environmental impacts of construction of a repository may be equivalent to those that would be encountered with similar large-scale, deep-mining activities. DOE PS at II-287. Similar industrial activities historically have been determined to be environmentally acceptable. Since the nonradiological impacts of concern for repository construction and operation will not differ in scope from previous mining experience, there is no basis for assuming that they would not be equally acceptable. They will be evaluated as required by existing statutes and regulations, including the National Environmental Policy Act. It was not the Department's intention to "downplay" potential environmental impacts, but rather to make the point that they are not unique.

Q. Page III-22, III.C.1.3., Detailed Site Characterization - During this phase of the proposed process, is all the necessary land needed for a repository purchased? Expanded below:

1. Does the purchase based on an already narrowed approach of site selection (banking) through the gathering of scientific and environmental data guarantee its development as a repository? If not, what future use will lands purchased for banking be used if found unacceptable as repository sites? WN PS, Leverance at 2.

R. Purchase of a site, as part of the banking process, does not guarantee that the site will be developed as a repository. If the site is determined to be unsuitable for a repository, the established procedures for the disposal of excess Federal property will be followed. Additionally, any public lands administratively withdrawn for site characterization will be for a limited number of years. DCE PS at III-49.

Q. Page III-32, III.C.3.1., Establishment of Regulatory Requirements for Mined Geologic Disposal - Within the process for narrowing the selection process for a suitable repository site:

1. Will sites that have a test shaft and exploratory tunnel receive any high level nuclear wastes for monitoring or test purposes?
 - a. If so, will these sites be licensed by the NRC? I am concerned that the mere process of narrowing the selection process to a few candidate sites accompanied with construction of a shaft and exploratory tunnel(s), may involve an ex post facto approval of their suitability.

Sites being examined for suitability receiving high level radioactive wastes, even for test purposes, should be licensed by the NRC.

All sites determined to be unacceptable following testing and analysis should be closed pursuant to a coordinated federal/state closure plan encompassing site rehabilitation and other contingencies. WN PS, Leverance at 2 and 3.

R. The in situ testing program in an exploratory shaft may involve testing with limited amounts of radioactive materials as part of the site characterization. The sources for such testing might be one or more spent-fuel elements. However, such radiation sources would be removed if a license to operate the repository were not issued. The decision to characterize a site more fully will not be a de facto decision to create a repository at the site. The Department does not need an NRC license to perform research and development activities. However, proposed NRC regulations would require close coordination between DOE and NRC during the site characterization activities. Unacceptable or unneeded sites would be restored and environmental impact review procedures would be followed. See Section II.B.5.4 of this Cross-Statement.

Q. Page III-38, III.D.1.2.1., Program Strategy - All comments received on the Draft Generic Environmental Impact Statement on the Management of Commercially Generated Radioactive Waste should be addressed within the Final EIS scheduled for issuance by October, 1980. WN PS, Leverance at 3.

R. This will be done.

Q. Page VI-II, VI-E, Transportation Considerations # 3 - With the understanding that 90 percent of the transportation of high level radioactive materials is scheduled to be performed by railroads:

1. Is a parallel program currently being developed to identify specific rail routes that will need:

- a. preservation from railroad abandonment.
 - b. upgrading in order to accommodate increased or heavier loads to meet safety standards.
2. Will the costs of revitalizing and rehabilitating the railroads be accomplished through a federal aids program or will these costs be incorporated into a user charge to the utility customer?

Transportation impacts through the use of a reliance on the railroads could thus add significantly to the cost of the consumer using nuclear generated power. WN PS, Leverance at 3.

R. See Chapter II.D of this Cross-Statement.

Q. The State of Wisconsin questions the projections of nuclear power growth set forth in Table V-1 of the Department's Position Statement. This Participant contends that the Department's projections are . . . in significant disagreement with ONWI-24 (Assumptions and Ground Rules Used in Nuclear Waste Projections and Source Term Data). WN PS, Mudrey at 11.

R. The following table compares the ONWI-24 projections and the Department's projections from DOE PS, Table V-1:

NUCLEAR POWER GROWTH (GWe)

<u>Year</u>	<u>ONWI-24 Table 2 at p.16</u>	<u>DOE PS Table v-1 at V-4</u>
1985	100-118	125
1990	150-175	171
1995	180-225	224

This comparison shows no "significant disagreement," and it demonstrates that the Department's values are consistent with the ONWI projection. The Department's projection is based on reactors currently operating, under construction, or committed;

and is consistent with the high growth projection in the Energy Information Administration (EIA) Annual Report to Congress. DOE PS, Ref. V-6. The values used in the ONWI-24 Report are those reported in the same EIA 1978 Annual Report.

Q. One Participant questioned the value of the Draft Environmental Impact Statement on the Management of Commercially Generated Radioactive Waste (DOE/EIS 0046) as a reference; DOE PS, Ref. II-28, in the the Department's Position Statement due to the Hearing Board's comments on that draft EIS given at DOE/EIS 0046 at D 23-24. Lewis PS at 4.

R. The Hearing Board did suggest a number of changes to the Draft EIS, many of which are being incorporated into the final EIS. The hearing board did not find the draft EIS to be seriously deficient, as implied in Mr. Lewis' Statement, as indicated in the following three items from the Hearing Board's conclusions:

- (1) The Statement seriously and impressively analyzes the environmental impacts of proposed actions for solving the problem of disposing of commercially generated high-level radioactive waste.
- (2) The Statement has served effectively as a vehicle for public comment and for indicating and generating changes that should be made in the final statement.
- (3) The Statement supports the conclusion, in principle, that commercially generated high-level radioactive waste can be disposed of by one or more alternative strategies with minimal and acceptable environmental consequences, and that the present preferred disposition is a deep, mined geologic repository.*

*U.S. Department of Energy, Hearing Board Comments on the Generic Environmental Impact Statement for the Management of Commercially Generated Wastes, (DOE/EIS-0046-D, April 1979), February 1980

The Department therefore submits that the Draft EIS is a proper reference as it is used in the DOE Statement.

APPENDIX B
EXCHANGE OF CORRESPONDENCE WITH STATE GOVERNORS



Department of Energy
Washington, D.C. 20585

NOTE: IDENTICAL LETTERS SENT TO
GOVERNORS OF ALL STATES EXCEPT
LA, MS, TX, NV, WA, UT, NM & SC.
IDENTICAL LETTERS ALSO SENT TO
HEADS OF TRIBAL GOVERNMENTS

JUL 3 1980

Honorable George R. Ariyoshi
Governor of Hawaii
State Capitol
Honolulu, Hawaii 96813

Dear Governor Ariyoshi:

As you are aware, there is great public interest in the safe management of radioactive wastes that originate in nuclear power programs that are vital to the defense and energy security of the United States. This interest, which has been expressed by citizens' groups as well as by representatives of State and local governments, has been considered in the President's program on radioactive waste management.

In a message to the Congress on February 12, 1980, a copy of which is enclosed for your information, the President set forth the features of a comprehensive National radioactive waste management program. A major aspect of this program involves efforts of the Federal Government to establish permanent repositories for disposal of high-level radioactive wastes. The program is now engaged in developing the technological and scientific basis for the design of facilities and the selection of sites which together will provide satisfactory margins of safety. There is a current need to expand and diversify the geologic investigations supporting site selection beyond those regions now under investigation. The President has stated an objective that final selection of the first disposal site be made from among several qualified sites in diverse geologic environments in various parts of the country.

The Department of Energy's currently active investigations are limited to seven States, and in order to implement the President's policy, it will be necessary for our investigations to be expanded into other regions. Since close consultation between Federal, State and Tribal Governments is a key ingredient of the Department's plans, I am, therefore, providing to each of the 50 States and to tribal officials a summary of key aspects of the program.

In recognition of the extreme importance of Federal, State and Tribal Governments working together in addressing National problems of radioactive waste management, the President established by Executive Order a State Planning Council to advise the President and the Congress and to recommend mechanisms for State and local review of, and participation in, radioactive waste management program activities and planning. The Council is not intended,

however, to supplant the role of individual State and Tribal Governments in negotiations with the Department of Energy. Governor Richard Riley of South Carolina is chairman of this body. A copy of the Executive Order establishing the Council and a list of its membership is enclosed for your information.

In a meeting on June 3, 1980, the State Planning Council discussed the need to expand the geologic exploration program and unanimously passed the following resolution:

"The Council endorses the President's policy of an expanded site characterization process for the selection of a permanent high-level waste repository. The Council recognizes that it is necessary for all states to participate with the Federal Government if this policy is to be implemented successfully."

The Council also recommended to the Department that the process of expansion of our activities should begin with a letter to all State Governors and to appropriate tribal officials, describing the process by which the program will be expanded and the steps required to select a possible repository site at any location several years in the future.

The enclosed table was prepared by State Planning Council staff for the June 3 meeting to support a discussion of the appropriate role for States in a consultation and concurrence process. The table describes steps that might need to be taken leading to operation of a geologic repository and a description of possible State or tribal involvement in a consultation and concurrence process. Council discussions clearly reflected the need to define more precisely the exact roles that should be played in the process by Federal, State, and Tribal Governments.

Prior to site selection, the process of site exploration will be conducted in a series of steps which can be generally summarized as follows:

1. A broad National survey of various geologic media and of geohydrological provinces identified by the United States Geological Survey is undertaken. This phase is generally conducted through literature studies and review of available geologic and hydrologic maps. Work of this nature has been underway for several years.
2. Regions of interest (usually spanning several States) that have been identified are further screened through more detailed review and field mapping to select areas where more specific data collection including core drilling might be undertaken.
3. Data taken in area studies are evaluated to recommend specific locations which then require very detailed geophysical tests to assess their suitability as potential sites for future selection.

We are committed to working with affected State and tribal authorities to gain a mutual understanding of the data being developed and the issues of concern to each party. We also plan to continue to work with the State Planning Council to define further the processes for interaction between the Federal and State Governments. Governor Riley and I both feel that your input will be very useful in helping to define more specifically the consultation and concurrence process that should accompany the siting studies.

At the present time, the Department is actively engaged in ongoing exploration studies in Louisiana, Mississippi, Nevada, New Mexico, Texas, Utah, and Washington. In each of these States, we have worked closely with State authorities to define mutually agreeable procedures for conducting the investigations and for keeping State officials informed of the progress of the work. We believe that our experience in these States can serve as a useful basis for defining similar arrangements as may be required in other States.

Initial recommendations of additional regions and provinces that should be examined are currently being developed by the Department's contractors and the U.S. Geological Survey. Based upon these recommendations, Department of Energy staff will shortly be seeking to consult with individual State governments to cooperatively plan investigations of new regions and provinces. Please note that this preliminary screening is the very beginning of a process that will require approximately 5 years before any specific repository locations are selected.

Whenever a program expansion would newly involve a specific State or group of States, or an Indian nation, we will contact the Office of the Governor in those States or the Indian Tribal Chairman to schedule a detailed briefing for any officials that the Governor or Tribal Chairman might designate. In this initial meeting, we would seek to establish appropriate consultation and concurrence procedures and explore the possibilities for cooperative studies involving both Federal and State scientists. Under no circumstances will the Department begin investigations for this program in a particular State or on Indian lands without prior discussions with the State or Tribal Government.

At the stage when broad regional investigations are proposed, we hope to be able to consult with affected States and Indian nations concurrently so that it will be clear to each that the proposals are regional and that no decisions have been made to concentrate on any individual State. In order to initiate the desired expansion of the program, we will soon contact specific States and Tribal Governments in which regions of interest have been identified. We do, however, prefer to learn whether our general notification process appears reasonable to the States and Indian nations before we begin. It would be most helpful if we could receive your comments on our proposed procedures within the next 30 days.

Your cooperation in helping to address this issue of vital importance to our Nation is sincerely appreciated.

Sincerely,

BSI

George W. Cunningham
Assistant Secretary
for Nuclear Energy

3 Enclosures

cc: Senator Richard S. H. Wong
President of the Senate

Representative James H. Wakatsuki
Speaker of the House



NOTE: IDENTICAL LETTERS SENT TO GOVERNORS OF
LA, MS, TX, NV, UT, NM & WA.

Department of Energy
Washington, D.C. 20585

JUL 3 1980

Honorable David Treen
Governor of Louisiana
State Capitol
Baton Rouge, Louisiana 70804

Dear Governor Treen:

As you are aware, there is great public interest in the safe management of radioactive wastes that originate in nuclear power programs that are vital to the defense and energy security of the United States. This interest, which has been expressed by citizens' groups as well as by representatives of State and local governments, has been considered in the President's program on radioactive waste management.

In a message to the Congress on February 12, 1980, a copy of which is enclosed for your information, the President set forth the features of a comprehensive National radioactive waste management program. A major aspect of this program involves efforts of the Federal Government to establish permanent repositories for disposal of high-level radioactive wastes. The program is now engaged in developing the technological and scientific basis for the design of facilities and the selection of sites which together will provide satisfactory margins of safety. There is a current need to expand and diversify the geologic investigations supporting site selection beyond those regions now under investigation. The President has stated an objective that final selection of the first disposal site be made from among several qualified sites in diverse geologic environments in various parts of the country.

The Department of Energy's currently active investigations are limited to seven States, and in order to implement the President's policy, it will be necessary for our investigations to be expanded into other regions. Since close consultation between Federal, State and Tribal Governments is a key ingredient of the Department's plans, I am, therefore, providing to each of the 50 States and to tribal officials a summary of key aspects of the program.

In view of the fact that we are presently conducting exploratory activities in Louisiana, I am sure that you and other responsible officials are familiar with our program and the ongoing consultation between the Department of Energy and State officials. I am sure, however, that the expansion of our program into other States will be of interest to you and am therefore providing you with this letter to all States so that you are advised of our future plans.

In recognition of the extreme importance of Federal, State and Tribal Governments working together in addressing National problems of radioactive waste management, the President established by Executive Order a State Planning Council to advise the President and the Congress and to recommend mechanisms for State and local review of, and participation in, radioactive waste management program activities and planning. The Council is not intended, however, to supplant the role of individual State and Tribal Governments in negotiations with the Department of Energy. Governor Richard Riley of South Carolina is chairman of this body. A copy of the Executive Order establishing the Council and a list of its membership is enclosed for your information.

In a meeting on June 3, 1980, the State Planning Council discussed the need to expand the geologic exploration program and unanimously passed the following resolution:

"The Council endorses the President's policy of an expanded site characterization process for the selection of a permanent high-level waste repository. The Council recognizes that it is necessary for all states to participate with the Federal Government if this policy is to be implemented successfully."

The Council also recommended to the Department that the process of expansion of our activities should begin with a letter to all State Governors and to appropriate tribal officials, describing the process by which the program will be expanded and the steps required to select a possible repository site at any location several years in the future.

The enclosed table was prepared by State Planning Council staff for the June 3 meeting to support a discussion of the appropriate role for States in a consultation and concurrence process. The table describes steps that might need to be taken leading to operation of a geologic repository and a description of possible State or tribal involvement in a consultation and concurrence process. Council discussions clearly reflected the need to define more precisely the exact roles that should be played in the process by Federal, State, and Tribal Governments.

Prior to site selection, the process of site exploration will be conducted in a series of steps which can be generally summarized as follows:

1. A broad National survey of various geologic media and of geohydrological provinces identified by the United States Geological Survey is undertaken. This phase is generally conducted through literature studies and review of available geologic and hydrologic maps. Work of this nature has been underway for several years.
2. Regions of interest (usually spanning several States) that have been identified are further screened through more detailed review and field

mapping to select areas where more specific data collection including core drilling might be undertaken.

3. Data taken in area studies are evaluated to recommend specific locations which then require very detailed geophysical tests to assess their suitability as potential sites for future selection.

We are committed to working with affected State and tribal authorities to gain a mutual understanding of the data being developed and the issues of concern to each party. We also plan to continue to work with the State Planning Council to define further the processes for interaction between the Federal and State Governments. Governor Riley and I both feel that your input will be very useful in helping to define more specifically the consultation and concurrence process that should accompany the siting studies.

At the present time, the Department is actively engaged in ongoing exploration studies in Louisiana, Mississippi, Nevada, New Mexico, Texas, Utah, and Washington. In each of these States, we have worked closely with State authorities to define mutually agreeable procedures for conducting the investigations and for keeping State officials informed of the progress of the work. We believe that our experience in these States can serve as a useful basis for defining similar arrangements as may be required in other States.

Initial recommendations of additional regions and provinces that should be examined are currently being developed by the Department's contractors and the U.S. Geological Survey. Based upon these recommendations, Department of Energy staff will shortly be seeking to consult with individual State governments to cooperatively plan investigations of new regions and provinces. Please note that this preliminary screening is the very beginning of a process that will require approximately 5 years before any specific repository locations are selected.

Whenever a program expansion would newly involve a specific State or group of States, or an Indian nation, we will contact the Office of the Governor in those States or the Indian Tribal Chairman to schedule a detailed briefing for any officials that the Governor or Tribal Chairman might designate. In this initial meeting, we would seek to establish appropriate consultation and concurrence procedures and explore the possibilities for cooperative studies involving both Federal and State scientists. Under no circumstances will the Department begin investigations for this program in a particular State or on Indian lands without prior discussions with the State or Tribal Government.

At the stage when broad regional investigations are proposed, we hope to be able to consult with affected States and Indian nations concurrently so that it will be clear to each that the proposals are regional and that no decisions

have been made to concentrate on any individual State. In order to initiate the desired expansion of the program, we will soon contact specific States and Tribal Governments in which regions of interest have been identified. We do, however, prefer to learn whether our general notification process appears reasonable to the States and Indian nations before we begin. It would be most helpful if we could receive your comments on our proposed procedures within the next 30 days.

Your cooperation in helping to address this issue of vital importance to our Nation is sincerely appreciated.

Sincerely,

/s/

George W. Cunningham
Assistant Secretary
for Nuclear Energy

3 Enclosures

cc: Senator Michael H. O'Keefe, Jr.
President of the Senate

Representative John Hainkel, Jr.
Speaker of the House

Enclosure I

President's Message to Congress.

See DOE PS, App. A

Enclosure II

Executive Order Establishing State Planning Council's Membership of State Planning Council.

(Not included in this document)

Enclosure III

Table of Possible Steps in the Consultation and Concurrence Process.

See DOE CS, II.A.4-1



Department of Energy
Washington, D.C. 20585

JUL 3 1980

Honorable Richard Riley
Governor of South Carolina
State House
Columbia, South Carolina 29211

Dear Governor Riley:

As agreed following the last meeting of the State Planning Council, we are sending letters to the leaders of each of the 50 States and of Tribal Governments. The following paragraphs constitute the text of these letters, except that in the letters to other Governors we have also identified your role as Chairman of the Council.

As you are aware, there is great public interest in the safe management of radioactive wastes that originate in nuclear power programs that are vital to the defense and energy security of the United States. This interest, which has been expressed by citizens' groups as well as by representatives of State and local governments, has been considered in the President's program on radioactive waste management.

In a message to the Congress on February 12, 1980, a copy of which is enclosed for your information, the President set forth the features of a comprehensive National radioactive waste management program. A major aspect of this program involves efforts of the Federal Government to establish permanent repositories for disposal of high-level radioactive wastes. The program is now engaged in developing the technological and scientific basis for the design of facilities and the selection of sites which together will provide satisfactory margins of safety. There is a current need to expand and diversify the geologic investigations supporting site selection beyond those regions now under investigation. The President has stated an objective that final selection of the first disposal site be made from among several qualified sites in diverse geologic environments in various parts of the country.

The Department of Energy's currently active investigations are limited to seven States, and in order to implement the President's policy, it will be necessary for our investigations to be expanded into other regions. Since close consultation between Federal, State and Tribal Governments is a key ingredient of the Department's plans, I am, therefore, providing to each of the 50 States and to tribal officials a summary of key aspects of the program.

In recognition of the extreme importance of Federal, State and Tribal Governments working together in addressing National problems of radioactive

waste management, the President established by Executive Order a State Planning Council to advise the President and the Congress and to recommend mechanisms for State and local review of, and participation in, radioactive waste management program activities and planning. The Council is not intended, however, to supplant the role of individual State and Tribal Governments in negotiations with the Department of Energy. A copy of the Executive Order establishing the Council and a list of its membership is enclosed for your information.

In a meeting on June 3, 1980, the State Planning Council discussed the need to expand the geologic exploration program and unanimously passed the following resolution:

"The Council endorses the President's policy of an expanded site characterization process for the selection of a permanent high-level waste repository. The Council recognizes that it is necessary for all states to participate with the Federal Government if this policy is to be implemented successfully."

The Council also recommended to the Department that the process of expansion of our activities should begin with a letter to all State Governors and to appropriate tribal officials, describing the process by which the program will be expanded and the steps required to select a possible repository site at any location several years in the future.

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Prior to site selection, the process of site exploration will be conducted in a series of steps which can be generally summarized as follows:

1. A broad National survey of various geologic media and of geohydrological provinces identified by the United States Geological Survey is undertaken. This phase is generally conducted through literature studies and review of available geologic and hydrologic maps. Work of this nature has been underway for several years.
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We are committed to working with affected State and tribal authorities to gain a mutual understanding of the data being developed and the issues of concern to each party. We also plan to continue to work with the State Planning Council to define further the processes for interaction between the Federal and State Governments.

At the present time, the Department is actively engaged in ongoing exploration studies in Louisiana, Mississippi, Nevada, New Mexico, Texas, Utah, and Washington. In each of these States, we have worked closely with State authorities to define mutually agreeable procedures for conducting the investigations and for keeping State officials informed of the progress of the work. We believe that our experience in these States can serve as a useful basis for defining similar arrangements as may be required in other States.

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Whenever a program expansion would newly involve a specific State or group of States, or an Indian nation, we will contact the Office of the Governor in those States or the Indian Tribal Chairman to schedule a detailed briefing for any officials that the Governor or Tribal Chairman might designate. In this initial meeting, we would seek to establish appropriate consultation and concurrence procedures and explore the possibilities for cooperative studies involving both Federal and State scientists. Under no circumstances will the Department begin investigations for this program in a particular State or on Indian lands without prior discussions with the State or Tribal Government.

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Your cooperation in helping to address this issue of vital importance to our Nation is sincerely appreciated.

Sincerely,

/s/

George W. Cunningham
Assistant Secretary
for Nuclear Energy

3 Enclosures

cc: Senator L. Marion Gressette
President Pro Tem of the Senate

Representative Rex L. Carter
Speaker of the House

STATE OF COLORADO

EXECUTIVE CHAMBERS

136 State Capitol
Denver, Colorado 80203
Phone (303) 839-2471



Richard D. Lamm,
Governor

August 1, 1980

Mr. George W. Cunningham
Assistant Secretary for
Nuclear Energy
U. S. Department of Energy
Washington, D. C. 20585

Dear Mr. Cunningham:

Thank you for your letter of July 3, 1980, informing me of the efforts of the Federal government and the State Planning Council regarding high-level radioactive waste disposal. The procedure for notification of governors and Indian tribal chairmen is most appropriate and reasonable.

In 1979, the Colorado General Assembly enacted a statute which requires that high-level and transuranic radioactive waste disposal in Colorado be approved by the Governor and the Legislature. It also requires the Colorado Department of Health to develop criteria relating to proper radioactive waste disposal.

We feel that the first step is to develop such criteria prior to the investigation of the geology, hydrology, climatology, and economics of such a general site location; specific site determination would then follow. In Colorado, land use decisions are made at the local level. It is imperative that, in the establishment of any site, the selected site (or sites) meet the most restrictive yet reasonable criteria to preclude proliferation of marginal or inadequate sites requiring remedial measures in the future.

I appreciate the information provided in your letter and its attachments and trust that Colorado's comments on this matter will be considered in a positive sense by the DOE.

Sincerely,

Richard D. Lamm
Governor

cc: Dr. Frank Traylor, Executive Director, Colorado Department of Health
Monte Pascoe, Executive Director, Colorado Department of Natural Resources
Senator Fred Anderson
Representative Robert Burford



Office of the Governor
Atlanta, Georgia 30334

George Busbee
GOVERNOR

July 16, 1980

Mr. George W. Cunningham
Assistant Secretary for Nuclear Energy
Department of Energy
Washington, D.C. 20585

Dear Mr. Cunningham:

This acknowledges your letter to me dated July 3, 1980 concerning safe management of radioactive waste. I appreciate your writing and apprising me of the current waste site investigation programs and State Planning Council activities.

Radioactive waste management is an issue of vital concern to me. Due to its far-reaching impacts to the individual states and to the Nation as a whole, I have followed this issue closely. I am hopeful that the Department of Energy can take a leadership role in this area and work cooperatively with the states in finding a solution to this problem. I am encouraged to see from your letter that the Department of Energy has established that no waste site investigation would be initiated in a particular state without prior discussion with the involved state. In order for radioactive waste management programs to be effective and to gain acceptance, the states must be involved early in the planning and evaluation process.

Please be assured that the State of Georgia will be committed to and supportive of programs and policies that lend themselves to safe management of radioactive wastes. However, I wish to go on record again as being opposed to any waste management option at the Department of Energy Savannah River Plant, which could potentially endanger the groundwater resources of Georgia. In particular, as I have stated to the Department of Energy on many occasions in the past, the State of Georgia is unalterably opposed to a Savannah River Plant radioactive waste management option involving bedrock storage.

I appreciate hearing from you on this matter and look forward to continued cooperation with the Department of Energy.

Sincerely,

A handwritten signature in cursive script that reads "George Busbee".
George Busbee

Jackie Swigart
SECRETARY



John Y. Brown
GOVERNOR

COMMONWEALTH OF KENTUCKY
DEPARTMENT FOR NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION
OFFICE OF THE SECRETARY
FRANKFORT, KENTUCKY 40601
TELEPHONE 502 364-3350

July 21, 1980

George W. Cunningham
Assistant Secretary for
Nuclear Energy
Department of Energy
Washington, D.C. 20585

Dear Mr. Cunningham:

Your letter of July 3, 1980, to Governor Brown concerning high-level radioactive waste has been referred to me for reply.

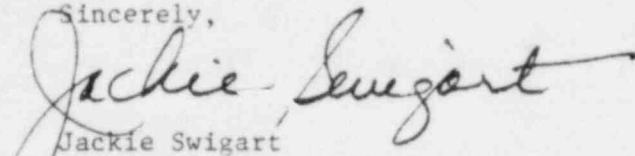
Due to our involvement in the management of low-level radioactive waste at the disposal site in Kentucky, we are particularly concerned about the proper disposal of high-level radioactive waste. Your proposal to involve Kentucky officials in the initial stages of any program to identify potential sites in our region appears to be a reasonable approach. We wish to be involved in the discussions concerning the areas to be evaluated, in the initial design of such evaluations, in the collection of data and in the assessment of the information collected from such evaluations.

Kentucky Revised Statute 211.852 requires that the location of a nuclear waste disposal site in Kentucky have the approval of this Department, the Department for Human Resources, the Governor and a majority of both the Kentucky House of Representatives and the Senate. To properly discharge these responsibilities it is clear that the parties involved in such decisions must be involved with the design and approval of the investigations to be conducted as well as our individual responsibilities for making the necessary decisions based on such evaluations.

Your enclosure, "Table of Possible Steps in the Consultation and Concurrence Process", describes a process that should allow us to be involved in the evaluations at the key stages that we need to be involved. We wish to be involved in any studies that are directed towards sites within Kentucky. We also wish to be involved in those projects that might be located outside our state but have an impact on us.

Thank you for making us aware of your effort in the selection of high-level radioactive waste repositories at this early stage of your work. We look forward to continuing to hear from you as these efforts continue.

Sincerely,


Jackie Swigart
Secretary

JS/sar

State of Louisiana



DAVID C. TREEN
GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

FRANK A. ASHBY JR.
SECRETARY

July 30, 1980

George W. Cunningham
Assistant Secretary for Nuclear Energy
U. S. Department of Energy
Washington, D.C. 20585

Dear Mr. Cunningham:

This is to acknowledge and thank you for your letter of July 3, 1980, to Governor David Treen concerning the management of radioactive waste and the proposed site selection process. Your correspondence has been forwarded to this office for reply.

As you accurately stated, the DOE is at present actively engaged in ongoing studies in Louisiana, and we have worked closely with Federal officials and contractors throughout the exploratory activities. The Nuclear Energy Division of the Department of Natural Resources has been designated as the official state liaison with the Department of Energy in this program, and a conference grant has been awarded to the Division to aid in conduct of these activities. During the 1980 Regular Session of the Louisiana Legislature, a concurrent resolution was passed for the purpose of establishing direct lines of communication with DOE relative to the studies currently being conducted, to make provisions for a consultation and concurrence process which will ensure full participation in all decisions relating to the studies, and to provide for oversight of all activities and a review of all data and information which come out of such studies. We are currently in the process of establishing a consultation and concurrence committee to initiate the mandate of this resolution.

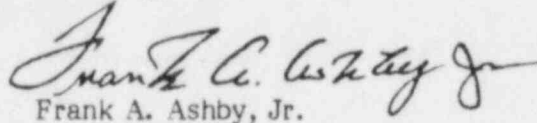
I am in favor of the approach taken by your office in dealing with this very sensitive matter, and agree that it is vitally important that the proper State and local representatives and organizations be kept knowledgeable throughout the entirety of this process. Additionally, it is felt that the States should be kept informed of interagency panel meetings, progress in the geological investigational phases of the program, and in the development of selection criteria and review procedures for site selection. We would be most interested in commenting on all draft statements concerning the environmental impact for the commercial waste management program and by direct participation in the development review procedures for site selection. Louisiana is certainly interested in maintaining close

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liaison with DOE on these activities and feel that it would be quite useful in the near future to receive a briefing on the current status of activities in Louisiana, conclusions of data, projected timetables, and further studies required in the State.

Thank you for your correspondence on this subject. We appreciate being kept as fully informed as possible on all aspects of the program.

Sincerely,

A handwritten signature in cursive script, appearing to read "Frank A. Ashby, Jr.", written in dark ink.

Frank A. Ashby, Jr.

FAA:dbz



STATE OF MINNESOTA

OFFICE OF THE GOVERNOR

ST. PAUL 55155

ALBERT H. QUIE
GOVERNOR

July 30, 1980

Mr. George W. Cunningham
Assistant Secretary for Nuclear Energy
U.S. Department of Energy
Washington, D.C. 20585

Dear Mr. Cunningham:

This letter is in response to your letter requesting comments on the planned procedures for radioactive waste management and site location selection process

As you may know, a member of my staff, representatives of the State Energy Agency and legislative staff attended the Department of Energy (DOE) briefing in Madison on July 9, 1980, requested by Governor Dreyfus.

I am opposed to any attempt to site such a facility in Minnesota.

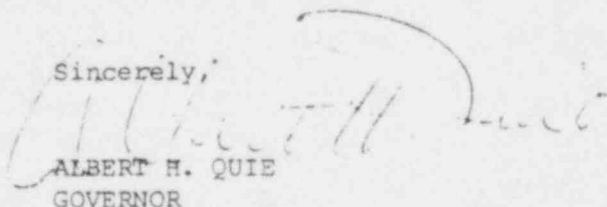
Matt Walton, Director of the Minnesota Geological Survey, has indicated to me that the so-called crystalline rocks of the Canadian Shield located in Minnesota are totally unsuited for nuclear waste isolation.

I strongly believe that high level radioactive waste management facilities should be located on federal lands away from population centers. Because these areas are well-known to DOE, site selection should be in inactive volcanic and salt formations.

The State of Minnesota will cooperate in providing information regarding soil, water, and rock formations that is maintained by State agencies. I would appreciate notification, in terms of a schedule, as to whom DOE is working with in this state. I would also appreciate it if you would contact Mr. Walton directly on this matter.

Thank you for the information and the opportunity to respond to DOE's proposed plans.

Sincerely,



ALBERT H. QUIE
GOVERNOR

AHQ:gbw

cc: Governor Lee Sherman Dreyfus, State of Wisconsin
State Senator Nicholas Coleman
State Representative Fred Norton
State Representative Gordon Voss
Minnesota Energy Agency Director Mark Mason

B-21

AN EQUAL OPPORTUNITY EMPLOYER



STATE OF NEW HAMPSHIRE

Concord, NH 03301

Hugh J. Gallen, Governor

July 24, 1980

George W. Cunningham
Assistant Secretary for
Nuclear Energy
Department of Energy
Washington, D.C. 20585

Dear Mr. Cunningham:

Thank you for your letter of July 3, 1980, and the enclosures.

I am in favor of the content of the President's message and, in particular, his intent that the Department of Energy assist in developing national plans to establish regional disposal sites for commercial low-level waste. The establishment of the State Planning Council, with its charge to advise the President and the Department on nuclear waste management, is to be commended.

The general scheme of the Consultation and Concurrence Process seems adequate. Regarding the location study phase through the site banking phase, it would appear that state concurrence is an absolute necessity. However, if all states should fail to concur, what then is to be done with high-level waste?

Thank you for the opportunity to comment.

Sincerely,

A handwritten signature in cursive script that reads "Hugh J. Gallen".

Hugh J. Gallen

HJG/jo



STATE OF NORTH DAKOTA

EXECUTIVE OFFICE

BISMARCK

ARTHUR A. LINK
Governor

July 29, 1980

Mr. George W. Cunningham
Assistant Secretary for
Nuclear Energy
Department of Energy
Washington, D.C. 20585

Dear Mr. Cunningham:

This is in response to your letter of July 3, 1980, concerning the federal government's program to establish permanent repositories for the safe disposal of high-level radioactive wastes.

A comprehensive national radioactive waste management program is essential to successfully deal with the problems of disposal of high-level, as well as low-level radioactive wastes. It is extremely important that federal, state and Tribal governments work together in addressing national problems of radioactive waste management. It is necessary that state and Tribal governments participate to the greatest extent possible with the federal government if the program is to be successful. A key part of this participation will be a responsive and well developed consultation and concurrence process.

The following comments are offered after reviewing the consultation and concurrence process described in your letter.

1. If a potential siting area affects or is on an Indian Reservation, both the Governor and the Indian Tribal Chairman should be contacted.
2. Written agreements between the federal, state and Indian governments should be stressed.
3. The power of the state or Indian governments to concur or not (i.e., approve or reject a site) must be upheld throughout the process.

The general notification process as detailed in your letter and attachments is reasonable.

Sincerely yours,

ARTHUR A. LINK
Governor



James A. Rhodes
GOVERNOR

OHIO DEPARTMENT OF ENERGY
30 East Broad Street 34th Floor
Columbus, Ohio 43215
(614) 466-1805

Robert S. Ryan
DIRECTOR

July 17, 1980

Mr. George W. Cunningham
Assistant Secretary for Nuclear Energy
U. S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Mr. Cunningham:

Your letter of July 3, 1980, addressed to Governor James A. Rhodes regarding the safe management of radioactive waste from nuclear power reactors has been forwarded to me for reply. We appreciate the opportunity to comment on the program outlined in that letter, and I am pleased to respond on behalf of the state of Ohio.

We are very much in favor of the involvement by the State Planning Council. They can be very helpful in the areas of guidance, support and consultation. They cannot be expected to provide the technical guidance; and I know that is not their purpose. However, too many times these groups want to duplicate other technical support groups.

We reviewed the Radioactive Waste Management Program which was released by the White House on February 12 and have been following subsequent events with equal interest. It has been our opinion that a tangible and consistent federal policy together with a workable program for implementation of a storage program was long overdue. For that reason, and knowing the complexities which arise in connection with the subject of nuclear waste disposal in Ohio, we want to lend our support to the efforts of the Department of Energy and the State Planning Council.

In a program as involved as this one, there is an inclination to take on many aspects and discuss them at length. I believe, however, that both of our interests will be best served if I focus simply on three elements that are most important to us. These are the matters of public participation and its implications; the banking or pre-designation of sites; and the need for federal legislation to insure that decisions rather than prolonged delays can be avoided.

We had earlier noted the sixth principal provision in the program as it was issued by the White House on February 12: "It is essential that all aspects of the waste management program be conducted with the fullest possible disclosure to and participation by the public and the technical community."

While endorsing both the desirability and the need for adequate public participation in a program of this kind, I would also suggest an equally adequate degree of realism. In Ohio, it has been our experience that public participation, simply left to its own devices, inevitably has the effect of lengthening and complicating rather than expediting a decision-making process, especially when the issues are as highly sensitive to emotion as nuclear waste disposal.

Keeping that point in mind and then turning to Table 1 attached to your letter ("Possible Steps in the Consultation and Concurrence Process"), it is apparent that in one way or another public knowledge that something "nuclear" is happening can be expected at an early stage of the process--probably at Phase 2 and certainly at Phase 3. Although we can only speculate at the moment on how this may affect the actual result as compared to the presumed result, it nevertheless is a question of some importance in keeping a realistic perspective on this program. The timing of public information is extremely important. In this very important issue, I am certain the State Planning Council can be very helpful.

On the matter of site banking (Phase 7 of Table 1). I might point out merely that Ohio, so far, has not generated much enthusiasm for this as a land-use concept if it is meant to include the actual irrevocable purchase of large tracts of land for an exclusive and perhaps unpopular future purpose such as nuclear waste disposal. Rather, we would tend to prefer the idea of site "designation" pending the completion of the site selection process.

Particularly at the stage in the process of site designation and site selection (Phase 7 and 8 of Table 1), where "state consent" and "state consensus" is required, it seems to us that the very real possibility of non-concurrence rather than concurrence must not be overlooked. It seems to me that Table 1 does not provide for the non-concurrence alternative.

There is a need for federal legislation if the consultation and concurrence process is to lead us toward final decisions rather than the time consuming frustration of extended public debate. We agree with the necessary ingredient of public discussion. This concept is highly commendable and necessary. However, I suspect that the results will be disappointing unless there are some guidelines supported by the law of the land, including the granting of ultimate decision making authority to Congress, the President, or some other executive/legislative combination at the federal level.

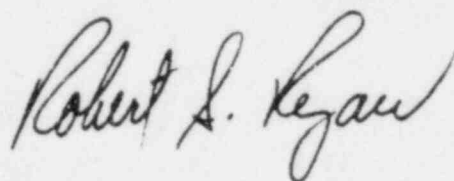
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As a final comment, several governors have suggested siting these disposal plants on Federal lands. This has a number of advantages. Of course, one advantage is that there is so much of it. Another is that it takes some of the onus off local politicians. Therefore, we would urge such a consideration.

Although there are recognizable areas of concern as my comments indicate, I would, however, like to emphasize Ohio's desire to participate constructively in this newly evolving process with the objective of helping to solve a critical national problem. Certainly during the early, exploratory phases of this program we are very much in favor of coordinating our efforts and views. The State Planning Council is an excellent mechanism for assisting in the complex issue of siting high level radioactive wastes. If there is anything we can do to assist this group, please let us know.

I hope that you will find these comments helpful in establishing a sound beginning for this program. Once again, thank you for providing us this opportunity for review and comment.

Sincerely,

A handwritten signature in cursive script that reads "Robert S. Legaw". The signature is written in dark ink and is positioned below the typed name "Robert S. Legaw".



COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

P.O. Box 2063
Harrisburg, Pennsylvania 17120



717-787-2814

The Secretary

July 31, 1980

Mr. George W. Cunningham
Asst. Secretary for Nuclear Energy
U.S. Department of Energy
Washington, D.C. 20585

Dear Mr. Cunningham:

The Governor has asked me to reply to your letter of July 3, 1980 seeking comments on the proposed general notification process for identifying suitable sites for high-level radioactive waste repositories.

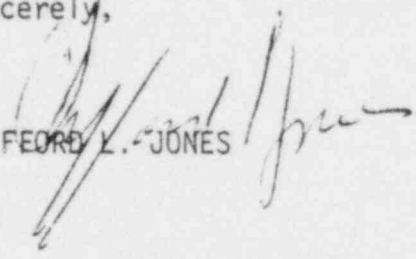
The general process outlined in the letter appears reasonable, however, it should be developed in considerably more detail prior to embarking on the steps which require specific State involvement.

For the consultation and concurrence process to be meaningful, early State participation is essential. In order to increase the depth of this State participation, the Department should consider providing grants to fund the State program that may be desirable. This will help to insure that the consultation process will be adequate to provide the necessary information for concurrence.

In addition, when the site selection process has been completed, incentives should be provided to the State and local governments in the affected areas to provide a further means of insuring that the process will be successful.

When additional detailed plans for consultation and concurrence have been developed, we would again appreciate the opportunity for comment.

Sincerely,


CLIFFORD L. JONES



State of Tennessee

LAMAR ALEXANDER GOVERNOR

August 12, 1980

Mr. George W. Cunningham
Assistant Secretary for
Nuclear Energy
U.S. Department of Energy
Washington, DC 20585

Dear Mr. Cunningham,

Governor Alexander was unable to see your letter to him concerning the national program for radioactive waste management before he left town for a few days. I will see that it comes to his attention when he returns. Meanwhile, I am taking the liberty of sharing it with Dr. Eugene Fowinkle, Commissioner of the Tennessee Department of Public Health, for his review in light of your desire for a timely response. Dr. Fowinkle will forward to you any additional comments we may have.

Thank you again for your informative letter.

Sincerely,

A handwritten signature in black ink that reads "Keel Hunt".

Keel Hunt
Special Assistant to the Governor

KH/ch

cc: Dr. Eugene Fowinkle



OFFICE OF THE GOVERNOR
STATE CAPITOL
AUSTIN, TEXAS 78711

WILLIAM P. CLEMENTS, JR.
GOVERNOR

25 April 1980

The Honorable Charles W. Duncan, Jr.
Secretary of Energy
U.S. Department of Energy
Room 7A-257 Forrestal Building
1000 Independence Avenue, SW
Washington, D.C. 20585

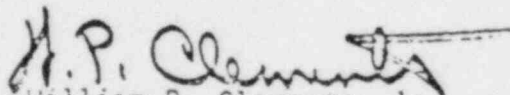
Dear Secretary Duncan:

We, in Texas, are certainly cognizant of the vital importance of a national solution to the problem of disposal of high-level nuclear wastes. The issue, without resolve, will continue to block the development of nuclear power needed in our efforts to move toward energy independence in the United States. However, a resolution of the problem cannot and will not occur without a full appreciation and recognition of the states' interests in the solution. The states must have a substantial involvement throughout the entire process of study, siting, design and operation of a high-level waste repository.

It is my understanding that your Department has the responsibility for management of high-level nuclear waste. I am also of the understanding that the Carter Administration, in recognition of the important role of the states and in order to more effectively and expeditiously reach an agreeable resolution of the issue, has pledged to insure full state participation. In order to facilitate the participation of the State of Texas in this process, I am designating the Texas Energy and Natural Resources Advisory Council as the lead agency to coordinate and communicate with the Department of Energy on high-level nuclear waste disposal issues.

I am confident that with meaningful state involvement this national issue can be resolved.

Sincerely,


William P. Clements, Jr.
Governor



TEXAS ENERGY AND NATURAL RESOURCES ADVISORY COUNCIL
411 WEST 13TH STREET, AUSTIN, TEXAS 78701

25 July 1980

Mr. George W. Cunningham
Assistant Secretary for Nuclear Energy
Department of Energy
Washington, D.C. 20585

Dear Mr. Cunningham:

On behalf of Governor Clements, I am responding to your letter of July 3, 1980. I am pleased that studies of alternative geologic formations in other states are being pursued in DOE's high-level waste storage program.

The notification process as outlined in your letter appears a reasonable approach. For purposes of coordination with the State of Texas, it is appropriate for you to work directly with me through the offices of the Texas Energy and Natural Resources Advisory Council as indicated in the attached letter to Secretary from Governor Clements dated April 25, 1980. I will look forward to further contact from your office regarding any program expansion in the State of Texas and associated briefings by the Department of Energy as indicated on page 3 of your letter.

Sincerely yours,

A handwritten signature in cursive script that reads "Milton L. Holloway".

Milton L. Holloway
Executive Director

/vle

Enclosure

cc: Governor William P. Clements, Jr.
Lt. Governor William P. Hobby
Speaker Bill Clayton



COMMONWEALTH of VIRGINIA

John N. Dalton
Governor

Office of the Governor
Richmond 23219

July 7, 1980

Mr. George W. Cunningham
Assistant Secretary for Nuclear Energy
Department of Energy
Washington, D. C. 20585

Dear Mr. Cunningham:

On Governor Dalton's behalf, thank you for your letter of July 3 regarding the President's National radioactive waste management program.

The detailed information you have provided will be brought to the Governor's attention as well as shared with other appropriate State officials for their review.

With kindest regards, I am

Sincerely,

Larry E. Murphy
Senior Executive Assistant

jw

COMMONWEALTH OF VIRGINIA



SENATE

EDWARD E. WILLEY
PRESIDENT PRO TEMPORE
10TH SENATORIAL DISTRICT
CITY OF RICHMOND
WESTERN PART OF
4810 NEWPORT DRIVE
P. O. BOX 9138
RICHMOND, VIRGINIA 23287

COMMITTEE ASSIGNMENTS:
FINANCE, CHAIRMAN
COMMERCE AND LABOR
EDUCATION AND HEALTH
LOCAL GOVERNMENT
RULES

July 14, 1980

Mr. George W. Cunningham
Assistant Secretary for Nuclear Energy
Department of Energy
Washington, D. C. 20585

Dear Mr. Cunningham:

Thank you very much for the recent copy of your letter to Governor Dalton and for the enclosed information on nuclear waste.

I appreciate so much having this information, because it is a subject that I am greatly interested in and that I feel has been greatly misunderstood.

I enjoyed the panel discussion held recently in Richmond, and I hope we are able to remove some of the phobias of the public. It seems that we are letting too many of these hippies frighten the public.

If you have any other information from time to time, I would appreciate having the benefit of it.

Sincerely,

A handwritten signature in cursive script that reads "Edward E. Willey".

Edward E. Willey

EEW:jrh



State of Wisconsin \ DEPARTMENT OF LOCAL AFFAIRS & DEVELOPMENT

Lee Sherman Dreyfus
Governor

Bruce A. Hendrickson
Secretary

DIVISION OF EMERGENCY GOVERNMENT

4802 SHEBOYGAN AVENUE
MADISON, WISCONSIN 53702

(608) 266-3232

May 8, 1980

Mr. Collin Heath
Department of Energy
Waste Isolation
1000 Independence Ave., S.W.
Washington, DC 20585

Dear Mr. Heath:

I am deeply concerned with a May 1 article which was printed in the Madison Capital Times (see enclosure). The article states that the Department of Energy and specifically Battelle Institute will be conducting a feasibility study for the siting of a high level nuclear waste depository. This study is to occur during the summer of 1980, yet neither the Governor nor the Governor's Radioactive Waste Disposal Committee was notified.

An understanding with both the Department of Energy and its predecessor requires that DOE notify the state of proposed testing and coordinate all planning efforts. There is no documentation that any notification occurred. This action is a severe violation of trust between the state and DOE. In addition, it violates the spirit of the proposed NRC regulations published in the Federal Register volume 44, number 236, on December 6, 1979. It is specifically counter to CFR 10 part 60.11(a)(6).

Repeated assurances that DOE supports the Interagency Review Group's theory of consultation and concurrence must be questioned. It is evident that DOE was prepared to begin testing in Wisconsin before such information was obtained by the press. You indicated to me in a May 1 telephone conversation that DOE fully intends to meet with the Governor and this executive committee within a month to discuss the testing. It is in the best interest of this state that when DOE considers initiating any procedures affecting Wisconsin that the Governor and the Committee be involved from the outset. Notification of DOE procedures through press release is unacceptable and adversely affects relations between state and federal government.

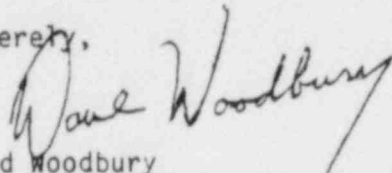
Understanding of consultation and concurrence is that appropriate state and local authorities should be informed of and involved in the siting procedures from the beginning. Therefore, it is essential that you provide all information, no matter how preliminary, on when, how, and where the testing will be conducted in the state so that joint efforts can proceed. The immediate release of such information could establish a better federal-state working relationship.

Mr. Collin Heath
May 8, 1980
Page Two

It is unfortunate that such a situation has occurred. Only continual and timely information exchange between your department and our committee on each other's actions could repair this breach of confidence. The Committee invites a DOE representative to participate in our scheduled meetings. I will send you a notice of the next full committee meeting and an agenda. Please inform us of a time most convenient to meet with us.

Address: Radioactive Waste Disposal Committee, 480.2
Sheboygan Ave., HFSOB, Room 99A
Phone: 608-266-1509

Sincerely,



David Woodbury
Coordinator and in the behalf of
the Governor's Radioactive Waste
Disposal Committee

DW:sg

cc: Governor Dreyfus
Secretary Duncan, DOE
Wisconsin Congressional Delegation

APPENDIX C
EXCHANGE OF CORRESPONDENCE WITH WISCONSIN OFFICIALS

MAY 19 1980

Mr. David Woodbury
Executive Director
Governor's Radioactive Waste
Disposal Committee
State of Wisconsin
4802 Sheboygan Avenue
Madison, Wisconsin 53702

Dear Mr. Woodbury:

I appreciate receiving your letter of May 8 and your deep concern with the May 1 article which appeared in the Madison Capital Times. As I described to you in our May 1 telephone conversation, I am equally distressed with the publication of the article before we had the opportunity to discuss the need for expanded geologic investigations with responsible State officials.

Let me repeat my apologies of May 1 to the officials of the State of Wisconsin about the way in which this information on our advance planning was released. As frequently stated by this Department and by the President in his February 12 message to the Congress, we fully intend to consult with State authorities about all aspects of our exploratory program and have been planning the simultaneous notification of several States about our interest in expanding the extent of our exploration program for some weeks.

I completely agree with you that State and local authorities should be informed of and involved in the siting procedures from the beginning. As soon as we develop specific proposals for investigative work which might be conducted simultaneously in Wisconsin and other States of interest, we will immediately seek the opportunity to meet with the the Governor and with your Committee.

We presently anticipate discussion of our notification procedures with the State Planning Council on Radioactive Waste Management at a meeting to be held on June 3. Shortly thereafter, we do expect to be seeking to meet with officials of several States.



STATE OF WISCONSIN
OFFICE OF THE GOVERNOR

STATE CAPITOL
MADISON, 53702

LEE SHERMAN DREYFUS

May 30, 1980

Telephone Number
(608) 266-1212

Mr. Colin A. Heath, Director
U.S. Department of Energy
Division of Waste Isolation
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Mr. Heath:

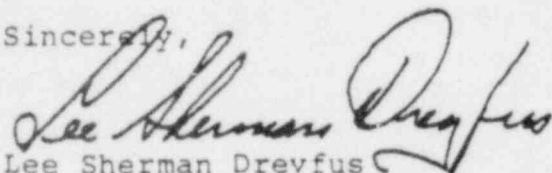
The long term disposal of high level radioactive waste represents a most difficult and important problem. Existing nuclear plants have generated wastes that have been held in temporary storage facilities. It is a problem that will not go away. Eventually, this country must resolve the long term disposal problem. However, the siting of a disposal facility will be possible only if it can be proven the facility will not be harmful to the human or natural environment. The disposal of these wastes is a federal responsibility. However, Wisconsin will do all in its power to protect the wealth of our people and environment.

The federal government has committed itself to a consultation and concurrence procedure with states affected by waste disposal plans or investigations. The key to this process must be timely, full and public disclosure of the information and plans of the federal government. On May 1st, Wisconsin received initial information on USDOE plans to conduct on-site investigations in Wisconsin. This information was confirmed by you through a telephone conversation with my staff. It was unfortunate we received the information through the media and not from USDOE. The credibility of federal officials must be restored.

It is critical that we have accurate information in a timely fashion on any USDOE plans for on-site investigations in Wisconsin. By this letter I am directly requesting USDOE officials to come to Wisconsin at the earliest practical date to present all available information on these plans, and to respond to our questions and concerns.

I look forward to a prompt response to this request.

Sincerely,


Lee Sherman Dreyfus
GOVERNOR

C-2

MAY 30 1980

Correspondence reviewer: Renee Coleman

See attached yellow for previous concurrences. Minor changes in text made by S. Meyers.

Ms. Mary Louise Symon
Member, State Planning Council
Board of Supervisors
County of Dane
Court House
Madison, Wisconsin 53709

Dear Ms. Symon:

I have received a copy of your letter of May 5 to Governor Riley in which you express understandable concern over the newspaper article that appeared in the Madison Capital Times on May 1. I understand that Colin Heath spoke with you by telephone on the evening of May 5 and expressed his concern over the publication of such material before we had the opportunity to discuss the need for expanded geologic investigations with responsible State officials.

I want to assure you that it is the full intent of the Department of Energy to consult with the Governor of any affected State, appropriate State agencies and individual members of the State Planning Council about any proposed investigations in a specific State. We have been planning for some weeks a process in which we will simultaneously contact officials of several States about our need to expand our geologic investigation programs to several regions. I would like to repeat Dr. Heath's apologies to you and to the officials in the State of Wisconsin for this breakdown in the process.

I understand that a discussion of notification procedures to be used prior to expansion of our investigations will be included on the agenda of the next State Planning Council meeting on June 3.

I share your concern that the relationship between the State and Federal Governments in this area not be disrupted by premature disclosure of information before proper consultation. I know we can work closely together to avoid any further occurrences of this type.

Sincerely,

Original signed by
SHELDON MEYERS
Sheldon Meyers
Deputy Assistant Secretary
for Nuclear Waste Management

cc: Honorable Richard W. Riley
Governor of South Carolina

MAY 19 1980

2

Please accept my assurances that the Department does not intend in any way to conduct siting investigations in any State without prior notification of State officials. I hope that any future discussions will not be clouded by this unfortunate premature release of information.

Sincerely,

Colin A. Heath, Director
Division of Waste Isolation
Office of Nuclear Waste Management

cc: Mary Louise Symon
State Planning Council

John Stucker
Acting Executive Director
State Planning Council

JUN 18 1980

Honorable Lee Sherman Dreyfus
Governor of Wisconsin
State Capitol
Madison, Wisconsin 53702

Dear Governor Dreyfus:

I appreciate receiving your recent letter in which you identified your views on the long-term disposal of high-level radioactive wastes, which I believe reflect exactly the philosophy of the Department of Energy's radioactive waste management programs.

The Department is indeed committed to a process of consultation and concurrence with states affected by waste disposal plans or investigations. I would be most pleased to meet with you and provide you with information on the current status of our geologic investigation programs and plans that we have for expansion to areas of the country that are not currently being examined in our program.

I have spoken with your staff as to when it would be convenient to meet with you and your staff and understand that the afternoon of Wednesday, July 9, would be appropriate. I look forward to this meeting with you, and I hope that at that time we can adequately respond to your questions and your concerns.

Sincerely,

Colin A. Heath, Director
Division of Waste Isolation
Office of Nuclear Waste Management

WI:CAH:pr



STATE OF WISCONSIN
OFFICE OF THE GOVERNOR

STATE CAPITOL
MADISON, 53702

LEE SHERMAN DREYFUS

June 23, 1980

Telephone Number
(608) 266-1212

Mr. Colin Heath, Director
U.S. Department of Energy
Division of Waste Isolation
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Mr. Heath:

By this letter I am confirming the arrangements you have made with my staff for a meeting to explain and discuss USDOE's plan for on-site geological investigations in Wisconsin. The meeting will begin at 1:30 p.m. on Wednesday, July 9 and will be held in Room 421 South in the State Capitol Building.

I understand USDOE plans to conduct an examination of granite as one of the alternative mediums for the long term disposal of high level radioactive wastes. As a part of this investigation, plans are being formulated to examine the Canadian shield and these plans include on-site investigations in Wisconsin. The July 9th meeting will provide federal officials an opportunity to explain in more detail plans for on-site investigations and efforts toward development of a general procedure for the siting of waste disposal facilities. Since this information may be of some interest to the states of Michigan and Minnesota, I will extend an invitation to Governor's Milliken and Quie to attend the July 9 meeting.

Again, I appreciate your timely response to my May 30th request for a meeting and I look forward to a frank and open discussion. Mr. Mark Popovich of my staff will coordinate the arrangements. Please feel free to contact him at 104 East, State Capitol, Madison, 53703 or telephone (608) 266-7885.

Sincerely,

A handwritten signature in cursive script that reads 'Lee Sherman Dreyfus'.

Lee Sherman Dreyfus
GOVERNOR

tmk



State of Wisconsin \ PUBLIC SERVICE COMMISSION

STANLEY YORK, CHAIRMAN
EDWARD M. PARSONS, JR., COMMISSIONER
WILLIE J. NUNNERY, COMMISSIONER

Hill Farms State Office Building
Madison, Wisconsin 53702
(608) 266-1241

File No.

July 10, 1980

Mr. George W. Cunningham
Assistant Secretary for Nuclear Energy
U.S. Department of Energy
Washington, D.C. 20545

Dear Mr. Cunningham:

I would like to express my personal thanks to you regarding Mr. Colin Heath's briefing on the national waste terminal storage program presented in Madison, Wisconsin on Wednesday, July 9, 1980. He did a superb job in briefing Governor Dreyfus and other state officials from Minnesota and Michigan. It is this type of dialogue which will strengthen credibility in federal-state relations.

Sincerely,

A handwritten signature in cursive script, appearing to read "W. Nunnery".

Willie J. Nunnery
Commissioner

WJN:jh

cc: Colin Heath

APPENDIX D
PEER REVIEW GROUPS

Earth Science Review Group

Purpose:

To provide a documented, independent, objective, and credible peer review of all activities in the waste isolation earth science program; and an additional purpose is to establish an open line of communication with leading members of the scientific community regarding technical issues associated with geologic waste isolation.

Members:

<u>Name</u>	<u>Affiliation</u>
Dr. George Pinder	Princeton University
Dr. Frank Parker	Vanderbilt University
Dr. John Bird	Cornell University
Dr. Neville Cook	University of California, Berkeley
Dr. Thomas A. Lang	Leed, Hill, & Jewett

State Geologists Technical Review Group

Purpose:

To provide DOE with independent evaluations of the methods used to determine the suitability of geologic formations for nuclear waste disposal

To determine the requirements for safe and environmentally acceptable geologic disposal of nuclear waste

To keep DOE informed on the status of geologic investigations into identification of possible sites for nuclear waste repository

To ensure that all state geologists in States which might be affected by the National Waste Terminal Storage Program are kept apprised of DOE activities relating to this program.

Members:

<u>Name</u>	<u>Affiliation</u>
William W. Hambleton, Chairman	Kansas Geological Survey
Normal K. Olson	South Carolina Geological Survey
Charles A. Ratte	Agency of Environmental Conservation, Vermont
Arthur E. Slaughter	Geological Survey Division, Michigan Department of Natural Resources
John W. Rold	Colorado Geological Survey
Vaughn E. Livingston, Jr.	Division of Geology and Earth Resources, Department of Natural Resources, Washington
Arthur A. Socolow	Bureau of Topographical and Geologic Survey, Department of Environmental Resources, Pennsylvania
Charles G. Groat	Louisiana Geological Survey, Louisiana

Program Review Committee

Purpose:

To provide a formal mechanism for the periodic evaluation of the ONWI/NWTS program that is concerned with the broader aspects of nuclear waste management. Social, legal, institutional, industrial, licensing, technical, and other types of issues impact on the waste management problem and on the manner

in which it will be resolved. The Program Advisory Committee will examine the approach, scope, and scheduling of the ONWI/NWTS program within this larger context and make recommendations for any modifications that could make the program more responsive.

The results of these reviews will be used as supporting documentation in the tendering of recommendations regarding program planning to DOE and as input to DOE communications with groups such as the Executive Planning Council and the National Governors Conference.

Members:

<u>Name</u>	<u>Affiliation</u>
Dr. William E. B. Benson	National Science Foundation
Yvonne Condell	Moorhead State College
Dorothy Ford	Southern California Edison
Dr. Hymer L. Friedell	Case Western Reserve University
Kenneth Guscott	Ken Guscott Associates
Dr. L. Charles Hebel	Xerox Corporation
Harry Kihn	Consultant (retired from RCA)
Dr. Thomas Langevin	President Emeritus, Capital University
Dr. John O'Connor	American Philosophical Association
James Porterfield	Farm Bureau Federation
Dr. Estus Smith	Jackson State University
Sheldon Steinbach	American Council on Education
Charlotte Toulouse	Citizen Groups
James McKendree Wall, Editor	"Christian Century" Newspaper

Geologic Exploration Group

Purpose:

To provide critical reviews and independent expert technical assessment of activities in geologic exploration for characterization and qualification of repository sites.

Members:

<u>Name</u>	<u>Affiliation</u>
Dr. Arthur L. Bloom	Cornell University
Dr. William Hambleton	Kansas Geological Survey
Dr. Irwin Remson	Stanford University
Dr. Howard Ross	University of Utah Research Institute
Dr. Charles Smith	University of Texas, Arlington

BWIP Geology Overview Committee

Purpose:

To critique and advise on the technical content of BWIP

Members:

<u>Name</u>	<u>Affiliation</u>
Dr. Donald Swanson	U.S. Geological Survey
Dr. Howard Ross	University of Utah Research Institute
Dr. Vaughn Livingston	Washington Department of Natural Resources

Dr. William Twenhofel U.S. Geological Survey
Dr. Irwin Remson (Chairman) Stanford University

BWIP Hydrology Overview Committee

Purpose:

To advise on hydrological aspects of BWIP

Members:

<u>Name</u>	<u>Affiliation</u>
Dr. Frank Parker	Vanderbilt University
Dr. Peder Grimstad	Washington Department of Ecology
Dr. Patrick Domenico (Chairman)	University of Illinois
Dr. Joseph Pearson	Intera Inc.
Dr. R. A. Freeze	University of British Columbia
Dr. S. P. Neuman	University of Arizona

BWIP Rock Mechanics Overview Committee

Purpose:

To advise regarding rock mechanics aspects of BWIP

Members:

<u>Name</u>	<u>Affiliation</u>
Dr. John Corwine (Chairman)	U. S. Bureau of Mines
Dr. William Hustrulid	Colorado School of Mines

Dr. Neville Cook

University of California, Berkeley

Dr. Jim Russell

Texas A&M University

Geological Investigations Peer Review Group

Purpose:

to oversee the exploration activities at NTS

Members:

<u>Name</u>	<u>Specialty</u>	<u>Affiliation</u>
Dr. Howard Ross	Geophysics	Univ. of Utah Research Institute
Dr. Paul Fenske	Hydrogeology	Desert Research Institute
Dr. John Handin	Geology/Rock Mechanics	Texas A&M University
Dr. Richard Wyman	Civil Engineering	University of Nevada, Las Vegas
Dr. L. T. Larson	Geology	University of Nevada, Reno
Dr. Patrick Domenico	Hydrogeology	University of Illinois

Media Studies Peer Review Group

Purpose:

To assist in selection of media on the NTS

Members:

<u>Name</u>	<u>Specialty</u>	<u>Affiliation</u>
Dr. John Handin	Geology/Rock Mechanics	Texas A&M University
Dr. James Russell	Geophysics	Texas A&M University

Dr. Paul Fenske	Hydrogeology	Desert Research Institute
Dr. Richard Wyman	Civil Engineering	University of Nevada, Las Vegas

Climax Spent Fuel Test Peer Review

Purpose:

To critique proposed test plans for the Climax Facility

Members:

<u>Name</u>	<u>Specialty</u>	<u>Affiliation</u>
Dr. John Handin	Geology/Rock Mechanics	Texas A&M University
Dr. William McClain	Mining Engineering	RE/SPEC
Dr. Neville Cook	Mining Engineering	University of California, Berkeley
Dr. Paul Fenske	Hydrogeology	Desert Research Institute
Dr. James Russell	Geophysics	Texas A&M University
Dr. Richard Wyman	Civil Engineering/ Geology	University of Nevada, Las Vegas
Dr. Lawrence Larson	Geology	University of Nevada, Reno

Technical Advisory Committee

Purpose:

This Review Group is being established to examine the scopes and schedules of ONWI technical programs and their integration with closely related programs, as requested by ONWI. It will recommend actions to strengthen the technical programs, particularly in the areas of technical quality, completeness of coverage, and responsiveness to outstanding technical problems.

Members:

<u>Name</u>	<u>Specialty</u>	<u>Affiliation</u>
Dr. F. W. Albaugh, Chairman	Process Chemistry	Independent Consultant
Dr. T. W. Ambrose	Mechanical/Chemical Engineering	Corporate Director, BMI
R. F. Bauer	National Resources Industrialist	Global Marine, Inc.
Dr. James L. Boyd	Physical Geology	Retired, Consultant
Dr. O. H. Greager	Process Chemistry	Independent Consultant
Dr. Walter Hibbard	Materials Science and Engineering	Professor, Virginia Polytechnic Institute
Dr. Ronald Howard	Economics/Systems Analysis	Stanford University
Dr. K. Krauskoff	Geology/Geochemistry	Stanford University
Dr. Joseph Lieberman	Radiological Science	Nuclear Safety Associates
Dr. Leland Jan Turk	Geology/ Hydrology	University of Texas

Tectonic, Seismicity, and Volcanism Peer Review Group

Purpose:

To address specific problems in tectonic, seismicity, and volcanism areas at NTS.

Members:

<u>Name</u>	<u>Specialty</u>	<u>Affiliation</u>
Dr. Richard Wyman	Civil Engineering/ Geology	University of Nevada, Las Vegas

Dr. John Willbank	Geology	University of Nevada, Las Vegas
Dr. Jerry Hoffer	Geology/ Volcanology	University of Texas, El Paso
Dr. George Thompson	Geophysics/ Tectonics	Stanford University
Dr. Alan Ryall	Geophysics/ Seismology	University of Nevada, Reno
Dr. Stanley Schumm	Geology	Colorado State

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

IN THE MATTER OF)
)
PROPOSED RULEMAKING ON THE STORAGE) PR-50, 51 (44 FR 61372)
AND DISPOSAL OF NUCLEAR WASTE)
)
(Waste Confidence Rulemaking))
_____)

CERTIFICATE OF SERVICE

I hereby certify that I have served two copies (unless otherwise noted) of the foregoing document, entitled "Cross-Statement of the United States Department of Energy," by mail or hand delivery, upon the following, this 5th day of September 1980:

Marshall E. Miller, Esq.
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555
(one copy)

David Santee Miller, Esq.
213 Morgan Street, N.W.
Washington, D.C. 20001

E. Leo Slaggie, Esq.
Office of the General Counsel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
(one copy)

Mr. Eugene N. Cramer
Neighbors for the Environment
17146 Ridgepark
Hacienda Heights, California
91745

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U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
(Original and 39 copies by hand)

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Assistant Attorney General
500 Pacific Building
520 S. W. Yamhill
Portland, Oregon 97204

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Rulemaking and Enforcement Division
Office of the Executive Legal Director
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Washington, D.C. 20555
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Harmon and Weiss
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Washington, D.C. 20006

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Division of Waste Management
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
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Mr. Marvin L. Lewis
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Philadelphia, Pennsylvania 19149

Mr. Edward P. Regnier
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U.S. Nuclear Regulatory Commission
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Safe Haven, Ltd.
3741 Koehler Drive
Sheboygan, Wisconsin 53081

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Two World Trade Center
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Boulder, Colorado 80302
(one copy)

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State College, Pennsylvania 16801

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Harvey S. Price, Esq.
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Atomic Industrial Forum, Inc.
7101 Wisconsin Avenue
Washington, D.C. 20014

Mr. Creg Darby
Hanford Conversion Project
1817 N.E. 17th
Portland, Oregon 97212

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Director, Department of
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State of California
1416 Ninth Street
Sacramento, California 95814

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Capital Legal Foundation
1101 17th Street, N.W., Suite 810
Washington, D.C. 20036

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2315 Camas Avenue
Richland, Washington 99352

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Environmental Policy Institute
317 Pennsylvania Avenue, S.E.
Washington, D.C. 20003

Christopher Ellison, Esq.
California Energy Commission
1111 Howe Avenue
Sacramento, California 95825

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Vice President and General Manager
General Electric Company
175 Curtner Avenue
San Jose, California 95125

Mr. Ken Kramer
Lone Star Chapter of the
Sierra Club
P.O. Box 1931
Austin, Texas 78767

Mr. Robert Halstead
Department of Administration
State of Wisconsin
1 West Wilson Street
Madison, Wisconsin 53702

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Assistant Attorney General
Supreme Court Building
1101 East Broad Street
Richmond, Virginia 23219

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