

UNITED STATES  
NUCLEAR WASTE TECHNICAL REVIEW BOARD

FALL BOARD MEETING: SITE-SUITABILITY ISSUES

October 12, 1994  
Alexis Park Hotel  
Las Vegas, Nevada

BOARD MEMBERS PRESENT

Dr. John E. Cantlon, Chairman, NWTRB  
Dr. Clarence R. Allen, Session Chair  
Dr. Garry D. Brewer  
Dr. Edward J. Cording  
Dr. Donald Langmuir  
Dr. John J. McKetta

CONSULTANTS

Dr. Patrick A. Domenico  
Dr. Ellis D. Verink  
Dr. Dennis L. Price

SENIOR PROFESSIONAL STAFF

Dr. Carl Di Bella  
Dr. Sherwood Chu  
Dr. Leon Reiter  
Dr. Daniel Fehringer  
Dr. Daniel Metlay  
Mr. Russell McFarland  
Dr. Victor Palciauskas

NWTRB STAFF

Dr. William D. Barnard, Executive Director, NWTRB  
Dennis Condie, Deputy Executive Director  
Paula Alford, Director, External Affairs  
Frank Randall, Assistant, External Affairs  
Karyn Severson, Congressional Liaison  
Nancy Derr, Director, Publications  
Linda Hiatt, Management Assistant  
Donna Stewart, Staff Assistant

I N D E X

	<u>PAGE</u>	<u>NO.</u>
<b>Opening Remarks</b>		
John Cantlon, Chairman. . . . .	3	
Nuclear Waste Technical Review Board (NWTRB)		
<b>FY 95 Program and Outlook</b>		
Daniel A. Dreyfus, Director . . . . .	5	
Office of Civilian Radioactive Waste Management		
<b>Session Introduction</b>		
Clarence Allen, NWTRB . . . . .	14	
<b>The Process for Determining Site Suitability</b>		
Stephan Brocoum/Jane Summerson. . . . .	20	
Department of Energy (DOE)		
<b>The NRC View of and its Role in the DOE's Site-Suitability Assessment</b>		
Malcolm Knapp, NRC . . . . .	91	
<b>Comments by the State of Nevada on the Process of Determining Site Suitability</b>		
Steve Frishman. . . . .	108	
Nuclear Waste Projects Office		
<b>Comments by the Nuclear Energy Institute (NEI) on the Process of Determining Site Suitability</b>		
Steven Kraft, NEI . . . . .	121	
<b>Exploration, Testing, and Data Collection Priorities for Technical Site Suitability Determination and Licensing, and Their Rationale</b>		
Jean Younker, M&O-TRW . . . . .	134	
<b>The Belgian Repository Concept and the Role of Engineered and Natural Barriers</b>		
J. Van Miegroet . . . . .	180	
The National Agency for Radioactive Waste and Enriched Fissile Materials (ONDRAF/NIRAS)		
<b>Crystalline Rock Repository Concepts and the Role of Engineered and Natural Barriers</b>		
Edward Patera, LANL . . . . .	194	
<b>Round-Table Discussion.</b> . . . . .	213	
<b>Closing Remarks and Adjournment</b>		

John Cantlon, Chairman, NWTRB . . . . . 284

1                           P R O C E E D I N G S

2           DR. JOHN CANTLON: Good morning. If you'll take your  
3 seats, we'll get the session under way.

4           My name is John Cantlon, and I chair the Nuclear  
5 Waste Technical Review Board, which we hereby declare open  
6 and ready for work. It's a pleasure to welcome you here to  
7 our fall board meeting.

8           With me today are Clarence Allen. Clarence is a  
9 Geologist and Professor Emeritus at Cal Tech. John McKetta  
10 over here on my right, Chemical Engineer and Professor  
11 Emeritus, University of Texas.

12           Ed Cording. Ed is a Geotechnical Engineer and  
13 Professor at the University of Illinois.

14           Gary Brewer. Gary is a Political Scientist and  
15 Dean of the School of Natural Resources and Environment at  
16 the University of Michigan.

17           Don Langmuir. Don is a Geochemist and Professor  
18 Emeritus at the Colorado School of Mines.

19           Also present are Pat Domenico. Pat is a  
20 Hydrologist and Professor from Texas A&M. Dennis Price, an  
21 Industrial and Systems Engineer and Professor from Virginia  
22 Polytechnic. Ellis Verink, a Metallurgical Engineer and  
23 Professor Emeritus, University of Florida.

24           My own field is Environmental Biology and I'm

1 former Vice-President for Research and Graduate Studies at  
2 Michigan State.

3           As most of you know, the Nuclear Waste Technical  
4 Review Board was created by Congress in the 1987 Amendment to  
5 the Nuclear Waste Policy Act created to assess the technical  
6 and scientific validity of the DOE's efforts in designing and  
7 managing their radioactive waste system, including site  
8 characterization and transportation and storage of high level  
9 waste.

10           We're happy to have with us today J. Van Miegroet.  
11 Mr. Van Miegroet is the Manager for Research and Waste  
12 Disposal at ONDRAF/NIRAS, the Belgian agency dealing with  
13 that country's radioactive waste. The Board had the pleasure  
14 of meeting with Mr. Van Miegroet during our trip to Belgium  
15 in 1993, and we're looking forward to his presentation this  
16 afternoon.

17           The main topics today are the site-suitability  
18 determination and the role of engineered and natural  
19 barriers. We will hear more about these topics later from  
20 Clarence Allen, who will be chairing that session. Garry  
21 Brewer will be moderating a round-table discussion following  
22 those presentations.

23           Before we get started on these topics, however,  
24 we'll hear from Dan Dreyfus, Director of the DOE's Office of  
25 Civilian Radioactive Waste Management, on OCRWM's FY 95

1 program and outlook.

2           Dan, thank you for taking the time to meet with us.

3           DR. DREYFUS: Thank you. I'm pleased that you invited  
4 me to be here this morning.

5           Just this past week, I completed one year as  
6 Director of the program, and that in and of itself is  
7 probably an accomplishment.

8           My last formal meeting with the Board I think was  
9 just shortly after my confirmation, and at that point, I gave  
10 you my early appraisal of the problems that I thought  
11 confronted the program.

12           My experience and the new developments since that  
13 time have confirmed some of my early impressions and changed  
14 some others. I'd like to share with you today some of my  
15 current views on where the program is, where it is going and  
16 especially the near-term situation.

17           I believe that we can continue to pursue site  
18 suitability and subsequent licensing of a repository within  
19 the general statutory and regulatory parameters that we now  
20 already have. And I'm convinced that the effort can be  
21 performed in a scientifically and socially defensible manner  
22 while meeting the requirements for cost control and political  
23 requirements to make demonstrable progress and to maintain  
24 meaningful targets.

25           I contend that we have already taken the

1 initiatives that are necessary to put the program on that  
2 basis. It will, of course, take a while for those  
3 initiatives to ripen into work in progress.

4           Now, I don't mean to imply that I'm confident of  
5 the ultimate outcome. This undertaking is fraught with  
6 uncertainties. The physical characteristics of any geologic  
7 setting are inherently complex, and the technical challenges  
8 of very long term predictive models that we are undertaking  
9 here are unprecedented.

10           More significantly, perhaps, the ultimate objective  
11 of this program is to provide adequate assurance to society  
12 that the permanent geologic disposal of high level waste can  
13 be met with acceptable standards of health, safety and  
14 environmental protection. And I would stress the word  
15 acceptable. In the final analysis, the test of adequacy must  
16 be and will be a social judgment that will be made in a  
17 political setting. So we cannot have certainty that the  
18 judgment will be favorable, even if the technical attributes  
19 of the undertaking meet our scientific notions of  
20 acceptability.

21           Our mission is to do an honest and competent job of  
22 collecting sufficient data, doing rational analyses and  
23 making the showing that is necessary for the regulatory and  
24 political decisions to proceed.

25           I think we can do that, and do it within the

1 constraints of time and money that will be allowed us. The  
2 alternative, of course, would be to abandon deep geologic  
3 disposal as an option by default before a social judgment on  
4 the merits can be made.

5           In the face of limited resources, we must  
6 concentrate scientific work first on essential factors of  
7 site suitability determination, and next upon the additional  
8 support required for regulatory determinations. In order to  
9 manage the program and demonstrate progress, we must set  
10 forth explicit tasks, associate the tasks with target dates  
11 and costs, and then we must control progress against those  
12 measures. I don't know any other way to manage a program.

13           I believe we have captured those objectives in the  
14 approach we are taking. Steve Brocoum and members of his  
15 staff will be describing that approach in detail to you  
16 today, and that is your principal agenda item.

17           I want to reiterate something that I think I said  
18 the last time. We are not making a choice here between  
19 continuing the program as it was or moving to some new  
20 approach for expedient reasons. The continuation of the  
21 program as it was was not a viable option when I was sworn  
22 in. External criticisms of the anticipated delays, the  
23 glaring inconsistency between the project work plan and the  
24 available resources could no longer be ignored.

25           The initial reception of our revised approach I

1 think has been encouraging. Most participants and most  
2 reviewers, while rightfully cautious, have taken a  
3 constructive attitude toward helping us accomplish our  
4 objective.

5           The Congress, acting on the faith that we can and  
6 will accomplish it, agreed to the Administration's proposed  
7 40 per cent increase in funding in '95, despite severe,  
8 government-wide budgetary restrictions. I am hopeful that  
9 the future year funding profile that was proposed with our  
10 '95 budget can be realized in the face of what are much more  
11 restrictive deficit controls across the government in the  
12 years ahead.

13           In '94, we continued to operate in a very severely  
14 constrained funding situation. We have found that '95,  
15 despite the large increase, that the program still requires  
16 tough priority choices and severe cost control to maintain  
17 the targets that we have set for accomplishment.

18           Most of the additional funding we received in '95  
19 will be allocated to the Yucca Mountain Site Characterization  
20 activity. Progress will be made on evaluation of site  
21 suitability, on the National Environmental Police Act  
22 compliance, on the resolution of licensing issues, and on the  
23 acquisition of information to support each of these.

24           In the coming year, we plan to finalize our site  
25 suitability evaluation process reflecting stakeholder input

1 and the input of reviewers such as this Board. We will  
2 prepare technical and compliance documentation to support  
3 decisions on five higher-level findings for guideline  
4 conditions related to surface processes.

5           We'll begin the formal NEPA process and will  
6 initiate scoping activities for the statutory Environmental  
7 Impact Statement needed for the repository. In the licensing  
8 area, we will complete the next revision of our Annotated  
9 Outline for a repository license application and we will  
10 issue that as a DOE document for the first time. We also  
11 expect to complete a topical report on seismic hazards, the  
12 second in a series of three on seismic issues, for submittal  
13 to the Nuclear Regulatory Commission for review.

14           Data acquisition and analysis activities will  
15 support progress in achieving our near-term milestones for  
16 suitability and licensing. These activities include both  
17 surface-based testing, and construction and testing in the  
18 exploratory studies facility.

19           With respect to the ESF, we started test-phase  
20 operation of the tunnel-boring machine last month. We plan  
21 to commence round the clock operations within the next few  
22 days. Over the next twelve months, we'll continue tunnelling  
23 to support our fiscal '96 milestones related to site  
24 suitability.

25           We expect to continue surface-based testing at

1 about the same level as in fiscal '94. We will emphasize  
2 testing and monitoring in existing drillholes. We will focus  
3 on long lead critical path activities. As part of the  
4 approach, we will be re-examining every investigation in our  
5 technical program to assess if the program is meeting the  
6 needs of suitability and licensing.

7           A major priority for '95 will be to assemble,  
8 analyze and qualify when necessary our existing data. Our  
9 principal objective is to demonstrate measurable progress  
10 towards a decision about site suitability during the year.

11           Waste acceptance and near term storage activities  
12 in '95 will concentrate on the multi-purpose canister and  
13 compliance with NEPA. In support of this initiative, we plan  
14 to conduct scoping meetings in advance of preparing an  
15 Environmental Impact Statement for the decision on deployment  
16 of the canisters, which would be made in the 1998 time frame.

17           We'll finalize a topical report on burn-up credit  
18 for storage and transportation and submit it to the NRC staff  
19 for review. I expect to address this issue with the  
20 Commissioners when I give them my semi-annual status briefing  
21 in December.

22           We will be evaluating the technical and cost  
23 proposals for the MPC design and certification that were  
24 called for in June. We would expect to complete review of  
25 the proposals during fiscal '95 and award one or more

1 contracts.

2           We placed a high priority on several aspects of  
3 program management. We intend to continue to clarify and  
4 complete the clarification of organizational roles, and  
5 making the participants more responsible and accountable for  
6 their work. We expect to achieve major benefits with the  
7 consolidation of our major participants under the technical  
8 direction of the M&O contract.

9           Effective last week, SAIC joined the M&O team and  
10 we'll be pursuing further integration and rationalization of  
11 contractor arrangements. I expect by the end of the year, to  
12 have the headquarters office and the Yucca Mountain office  
13 fully integrated, both across the organizational lines and  
14 across the geographic separation.

15           Now, beyond the immediate programmatic activities,  
16 I expect that during the next Congressional session we, and  
17 probably you, will also be involved with significant public  
18 policy debate concerning national radioactive waste policy.  
19 Judging from the existing lawsuits on waste acceptance, the  
20 public expressions already made by key members of Congress,  
21 and the extensive lobbying efforts that are already under  
22 way, there is little doubt that Congress will address  
23 radioactive waste policy next year. There is a lot less  
24 certainty about what the result is going to be.

25           The dimensions of the debate are taking form.

1 There is a need to relieve the constraints imposed upon the  
2 use of the Nuclear Waste Fund due to the caps on  
3 discretionary appropriations. I expect the Administration to  
4 propose again an approach to remove those constraints. There  
5 is a very broad consensus in the government and outside that  
6 a solution should be found to the waste fund issue. The  
7 problem of course is the deficit control is a very strong  
8 political imperative throughout the government today, and the  
9 way out of the current impasse is somewhat elusive.

10           The nuclear utilities and many reactor states have  
11 made clear their intention to seek an aggressive interim  
12 storage initiative. They proposed that Congress instruct and  
13 authorize the Department to take possession of spent fuel at  
14 the earliest possible time. The physical facilities to  
15 accomplish this goal, and especially the siting of those  
16 facilities, are somewhat less specific in the proposals.

17           It is certainly timely for the Congress to address  
18 the issue. The program needs guidance and it probably needs  
19 new authority to define its role in the near term management  
20 of commercial spent fuel.

21           A related issue is that the national policy does  
22 not now include a contingency plan should Yucca Mountain  
23 prove to be unacceptable. This Board and many other  
24 reviewers have called attention to that situation. If the  
25 site is rejected, we will confront at least a period of

1 several decades while another site is chosen and explored,  
2 and in some conceivable circumstances, a negative decision  
3 about Yucca Mountain might imply suspension or even total  
4 rejection of the geologic disposal strategy.

5           The national policy ought to include a  
6 Congressionally authorized and mandated contingency approach  
7 to address those possibilities. Reliance upon extended at-  
8 reactor storage for many decades would, in my view--and this  
9 is my own view--be a serious public policy failure. In any  
10 event, it should not become our national waste management  
11 strategy by default.

12           I expect these issues to be discussed in the next  
13 Congress. I hope that my office will make a substantive  
14 contribution to the debate, especially by providing sound  
15 advice on the practicality of the proposed options. I hope  
16 that this Board will be called upon and will come forward and  
17 do the same. It would be a tragedy if Congress were to spend  
18 a considerable amount time and effort on this policy and come  
19 up with something that proved to be unmanageable or  
20 infeasible.

21           Meanwhile, we have to establish confidence that the  
22 mission that we now have is being pursued in an effective and  
23 efficient way. We have quite an extended set of  
24 presentations today. I hope it will help build your  
25 confidence that we are heading on a course that is both

1 efficient and capable of succeeding.

2           We believe that many of your earlier comments have  
3 been incorporated in the approach we have taken, and we need  
4 your help in refining it.

5           Thank you, Mr. Chairman. I'm at your mercy, or  
6 service.

7       DR. CANTLON: Dan has agreed to take questions. Are  
8 there questions from the Board?

9           (No response.)

10       DR. CANTLON: Board staff?

11           (No response.)

12       DR. CANTLON: Audience?

13           (No response.)

14       DR. CANTLON: You lucked out.

15       DR. DREYFUS: Okay.

16       DR. CANTLON: Now Dr. Allen will take over the session.

17       DR. ALLEN: Thank you, John.

18           As everyone here knows, site suitability has become  
19 an increasingly important topic of discussion among those  
20 interested in Yucca Mountain. For example, the proposed  
21 program approach, so-called PPA, defines the determination of  
22 technical site suitability as the most important OCRWM effort  
23 in the next few years.

24           As we have heard, the DOE is presently engaged in  
25 further defining the process by which this decision will be

1 made. The DOE has already stated that it does not intend to  
2 revise the existing guidelines, 10 CFR 960, and will base its  
3 decision on technical site suitability on satisfying the  
4 qualifying and disqualifying conditions found in those  
5 guidelines.

6           The DOE has begun negotiating, as we understand it,  
7 with the National Research Council of the National Academy of  
8 Sciences regarding its participation in review of technical  
9 information reports related to suitability issues, site  
10 suitability issues.

11           To make the PPA operational, the Yucca Mountain  
12 Site Characterization Office is going through a process of  
13 priority screening by which it will emphasize those studies  
14 in the site characterization plan most related to the DOE's  
15 determination of technical site suitability and eliminate or  
16 delay until license application those that are not.

17           In response to the Board's questions on the PPA,  
18 the DOE indicated that it is starting to identify specific  
19 tests and data necessary to support its technical site  
20 suitability determination and that the technical  
21 implementation plan for FY 1995 will be ready by September of  
22 1994, currently rescheduled to October of 1994.

23           At the June, 1994 meeting of our panel on  
24 structural geology and geoen지니어ing, for example, the Board  
25 heard of a DOE strategy for exploration of the Calico Hills

1 formation based largely upon what is found at repository  
2 level excavations. Apparently if the Ghost Dance Fault is  
3 found to be a highly permeable structure, exploration of  
4 fault properties in the Calico Hills formation would be  
5 considered necessary for technical site suitability  
6 determination.

7           When asked if thermal behavior in properties were  
8 deemed to be a site suitability issue, we were informed that  
9 they would be only if they challenged the DOE's ability to  
10 make bounding calculations with respect to different thermal  
11 loading scenarios. For its part, the Board has questioned  
12 whether the DOE will have conducted thermal and other tests  
13 sufficiently long by 1998 or 2001 to understand that which  
14 needs to be understood about the safe disposal of radioactive  
15 waste at Yucca Mountain, and to make suitability and  
16 licensing decisions.

17           Another issue related to site suitability is the  
18 extent to which engineered barriers can be used to minimize  
19 or mitigate adverse natural conditions at a repository.  
20 Strong opinions have been expressed on this matter. Some  
21 argue, referring to 10 CFR 960, that engineered barriers  
22 should not be used to mask site deficiencies.

23           Others maintain that trade-offs between natural and  
24 engineered barriers are logical and that total system safety  
25 should be paramount. Although all countries working on

1 geological disposal support the concept of multiple barriers,  
2 there are great differences with respect to how this concept  
3 is implemented, as we shall see later in the day.

4           A final issue is the apparent importance the DOE  
5 has assigned to peer review and peer judgment in assessing  
6 site suitability. The DOE has stated that it will be  
7 deferring some tests and data gathering to the post-  
8 construction authorization phase. The Board discussed the  
9 general topic of expert judgment in its most recent report in  
10 which it evaluated many of the important topics raised at the  
11 DOE's 1992 workshop on expert judgment.

12           Although a workshop report has been completed and  
13 distributed, the Board is not yet aware of any plan that the  
14 DOE has for implementing the Board's recommendations.

15           This meeting should serve several purposes. First,  
16 it should give the Board an understanding of the process by  
17 which the DOE hopes to assess its site suitability. Draft  
18 descriptions of this process are already available. As an  
19 adjunct to this topic, the Board would like to know what the  
20 DOE plans are for the use of expert judgment in assessing  
21 site suitability.

22           Second, the meeting should help us understand and  
23 clarify what the DOE views as the main technical site  
24 suitability issues at Yucca Mountain and, therefore, the  
25 DOE's priorities with respect to exploration, testing and

1 data collection. This topic includes a clear delineation of  
2 the DOE's current waste isolation strategy.

3           The idea of a waste isolation strategy, sometimes  
4 called the Safety Concept or the Safety Case, has been used  
5 successfully by other countries in articulating in a clear  
6 and concise manner how a proposed repository will safely  
7 contain and isolate harmful radionuclides from the public and  
8 environment under a range of conditions in the future, and  
9 the role of different barriers and sub-barriers play--or the  
10 role they play in waste isolation.

11           An important aspect of delineating this strategy  
12 and setting priorities is the further identification of those  
13 features and events and processes that could pose a serious  
14 challenge for the site's viability, and the ability of  
15 testing and exploration to identify those potential  
16 disqualifiers.

17           A related topic is understanding the DOE's  
18 distinction between data analyses that are needed for the  
19 determination of site suitability and those needed for  
20 licensing.

21           Third, the meeting should form a forum for an  
22 expanded discussion of the roles assigned to natural and  
23 engineered barriers and the extent to which engineered  
24 barriers should be considered in evaluating site suitability.  
25 Of particular interest, of course, is the possibility of

1 trade-offs between engineered and natural barriers.

2           A detailed outline of the topics we'll be  
3 discussing can, of course, be found in the meeting agenda.  
4 We'll start off this session with a presentation by Steve  
5 Brocoum and Jane Summerson of the DOE on the process of site  
6 suitability determination, including a discussion of what the  
7 DOE means by site suitability, technical and otherwise, the  
8 use of 10 CFR 960, review procedures, stakeholder  
9 involvement, and the use of expert judgment.

10           We have also asked Mal Knapp of the Nuclear  
11 Regulatory Commission, Steve Frishman of the State of  
12 Nevada's Nuclear Waste Project Office, and Steve Kraft of the  
13 Nuclear Energy Institute to provide us with their  
14 perspectives of site suitability.

15           After lunch, Jean Younker of the M&O will discuss  
16 the DOE's priorities in testing and data collection. It is  
17 hoped that this presentation will be a springboard for an  
18 extended discussion on the DOE's waste isolation strategy,  
19 site suitability issues, and those features, events and  
20 processes that could pose a serious challenge to the site's  
21 viability.

22           The last part of the meeting will be a round-table  
23 discussion on natural and engineered barriers and their role  
24 in assessing site suitability. This round-table will be  
25 preceded by a short description of foreign programs which

1 have somewhat divergent views on the relative importance  
2 assigned to natural and engineered barriers.

3           J. Van Miegroet will describe the Belgian program,  
4 which places heavy reliance upon the natural barriers. Ed  
5 Patera, a Los Alamos scientist who spent several years  
6 working with the Nuclear Energy Agency in Paris, will  
7 describe the Scandinavian programs, which place heavy  
8 emphasis on the engineered barriers.

9           At the conclusion of the round-table, we will open  
10 the floor for public discussion. Garry Brewer will have more  
11 to say about the round-table later in the program.

12           The first presentation this morning is by Steve  
13 Brocoum and Jane Summerson, and I assume, Steve, that you  
14 will lead off.

15       DR. BROCOUM: Good morning. My name is Steve Brocoum.

16           I was going to talk about the background and  
17 overview for development of proposed site suitability  
18 evaluation process. Jane Summerson was actually going to  
19 talk about the process we are planning on implementing and  
20 later on this afternoon, Jean Younker will talk about the  
21 data needs and the uncertainties and what we know, what we  
22 still need to know on site suitability.

23           I'm going to give a little bit of history to kind  
24 of put it in context. In 1982, the Nuclear Waste Policy Act  
25 directed DOE to develop siting guidelines to assist the

1 siting process, and they had to have qualifying and  
2 disqualifying guidelines. They were developed by the  
3 consultation required by the Nuclear Waste Policy Act, and  
4 they included concurrence by the NRC.

5           One of the people that was very involved in doing  
6 that is here today, Carol Hanley. I'd like her to kind of  
7 stand up for a second. Is she here? If we have any  
8 questions about the guidelines and their history and the  
9 role, she is here, I know she's here--there she is, back  
10 there in the back of the room. It was a two and a half year  
11 process or so and DOE issued guidelines for recommending  
12 repositories in December of 1984.

13           Congress directed us to employ these guidelines as  
14 part of a screening process to identify multiple sites in  
15 various geologic media that would be suitable for further  
16 characterizations. Sites that were suitable for  
17 characterization would have been compared among each other  
18 and the three sites in different media were going to be  
19 recommended for characterization.

20           After completing site characterization determining  
21 the suitability of each site for development as a repository,  
22 the sites would be compared to each other and a single site  
23 was to be chosen and recommended to the President.

24           Now, the next viewgraph I am told is not in your  
25 package. But this viewgraph has been used many times in

1 front of the Board. It's just to remind ourselves that 960  
2 has 24 guidelines. They fall into four groups, post-closure  
3 performance, environmental, socioeconomic and transportation,  
4 pre-closure radiological safety and ease and cost of siting,  
5 construction, operation and closure. This is just a  
6 reminder. These have been discussed before. All of these  
7 have qualifying conditions. Most of them have disqualifying  
8 conditions.

9           When we talk about technical site suitability, we  
10 are talking about implementing this set of guidelines, that  
11 set of guidelines, and this set of guidelines. Those having  
12 to do with environmental, socioeconomic and transportation  
13 will be handled through the NEPA process. And the SCP  
14 addressed these three sets of guidelines.

15           How have the guidelines been applied? The  
16 guidelines were used, as required in the Nuclear Waste Policy  
17 Act, it originally nominated five sites suitable for  
18 characterization, and then recommending three of those sites  
19 to the President as candidate sites to be characterized for  
20 the first repository. Each site that was nominated was  
21 accompanied by environmental assessment in 1986 that included  
22 the evaluation of the suitability of that site under the  
23 guidelines, and four higher level findings were made for the  
24 Yucca Mountain site in the 1986 environmental assessment in  
25 the areas of dissolution, a qualifying and disqualifying

1 condition in the areas of population around the site.

2       Then a separate evaluation of each of the other sites  
3 was also required.

4           In May of 1986, the President approved the three  
5 sites recommended for characterization, including Yucca  
6 Mountain. However, in December of 1987, an amendment to the  
7 Nuclear Waste Policy Act eliminated the requirement for  
8 consideration of multiple sites and only provided that  
9 characterization would proceed only at the Yucca Mountain  
10 site to determine its suitability for development of the  
11 repository.

12           So DOE did prepare an SCP in accordance with the  
13 Nuclear Waste Policy Act for the Yucca Mountain site. The  
14 siting guidelines were identified as the criteria, as  
15 required by the Nuclear Waste Policy Act, to evaluate the  
16 suitability of that site. The SCP described how DOE proposed  
17 to address the guidelines and it also pointed out that those  
18 environmental, socioeconomic and transportation, those that  
19 required generally non-geologic or earth science data that  
20 were not covered in the SCP would be covered in the  
21 Environment Impact Statement. As defined by the Nuclear  
22 Waste Policy Act, the SCP was addressing more or less the  
23 earth science type of guidelines.

24           The SCP was submitted to the NRC and the State for  
25 their review and comments. It also identified the provisions

1 that were no longer applicable based on the 1987 amendment,  
2 and those kind of provisions had to do with comparing sites,  
3 multiple sites, with regard to performance or cost, because  
4 there were not multiple sites to be compared any more.

5           It identified the guidelines and how they would be  
6 handled. The implementing guidelines provide that before DOE  
7 can make a decision that a site is suitable and can be  
8 recommended to the President for development as a repository,  
9 the evidence should support findings by DOE that none of the  
10 disqualifying conditions are present and all the qualifying  
11 conditions are met and that based on the information DOE has  
12 at hand, based on their understanding of the uncertainty and  
13 based on all other information that can be brought to bear,  
14 that those conclusions are not likely to change with the  
15 collection of additional information. That is a higher level  
16 finding.

17           Other than the four that I said were higher level  
18 findings, were lower level findings. They met the first  
19 condition, none of the disqualifying conditions are present,  
20 they met the second one, that all the qualifying conditions  
21 are met, but they did not necessarily meet the third one. In  
22 other ones, we did not have enough information, we did not  
23 have enough understanding of the uncertainty that we had the  
24 confidence that that conclusion would not change in the  
25 future with additional data.

1           In the guidelines, a finding is defined as a  
2 conclusion that is reached after evaluation. There is no  
3 explicit provision in the guidelines requiring findings of a  
4 favorable or potentially adverse conditions. The reason is  
5 it was thought that it would be, based on the voluminous data  
6 that would be collected during site characterization, it  
7 would be possible to directly evaluate site performance  
8 against the qualifying conditions of a system and technical  
9 guidelines.

10           So when 960 was originally written, it was thought  
11 that these would be early indicators, and as more information  
12 became available, the qualifying conditions would be the more  
13 accurate, if you like, indicators because they would address  
14 the performance of the site.

15           However, 960 does say that the favorable and  
16 potentially adverse conditions will be considered in balance  
17 as part of the evaluation of a qualifying condition of the  
18 technical guidelines prior to making findings. So they're  
19 not ignored, but they're not explicit findings made against  
20 them.

21           Now, we have gotten several letters, one I think  
22 from the NRC, one from NEI questioning this issue, and Dan  
23 has asked us to look at this again, and we'll be looking at  
24 this again. And so as we finalize our process for evaluating  
25 site suitability and publish in the Federal Register, we will

1 address this issue as brought up in the letters.

2           In December of 1990, in implementing the Secretary  
3 of Energy's 1989 commitment to Congress to focus on site  
4 suitability, OCRWM directed that an early assessment of the  
5 Yucca Mountain site be performed under 10 CFR Part 960, based  
6 on the data that was available then.

7           That assessment was intended to determine if  
8 information collected since 1986 indicates that the site  
9 should be disqualified. And the reason that was so important  
10 was every time someone asked should a site be disqualified,  
11 we would say we are not aware of any information that should  
12 disqualify the site, but no formal evaluation had ever been  
13 made. And also it was designed to help us focus and  
14 prioritize data for acquisition activities.

15           The results of this assessment and external peer  
16 review were published in January of '92 as a contractor  
17 report and issued by DOE for public comment. And this was  
18 presented to the Board in 1992.

19           Where are we today? Today we have a Program  
20 Approach. As of October 1st, the proposed has been dropped,  
21 so the PPA has now become the Program Approach. I need to  
22 announce that we had said at previous meetings and in various  
23 other forums that there was a five year plan being developed.  
24 There is a copy of a pre-decisional draft, actually a  
25 document really in progress on the back table, I believe.

1 There's 100 copies for the audience and for the TRB.

2           This document, we have had many requests for this  
3 document, so we decided to release this pre-decisional draft.  
4 It is a document in progress. There may be inconsistencies  
5 in it. There is one chapter which is not in here; a chapter  
6 on the NEPA section is not here because still within DOE  
7 there is a lot of debate exactly how to proceed within NEPA,  
8 so that section is not included.

9           However, it is a document, and for example, if  
10 you're interested in which topical reports the DOE plans to  
11 submit to the NRC in 1997 or 1999, that kind of information  
12 is in here. So with regard to suitability and licensing, the  
13 information in the schedules in terms of preparation of  
14 documents is in here.

15           A few words on the proposed approach. And this has  
16 been said before and I'm just summarizing. Basically, the  
17 characterization program as we originally described in the  
18 SCP and reflected in the approved baseline could not be  
19 accomplished with the projected funding level. The funding  
20 level was about half every year of what that approved  
21 baseline required. That was the baseline where we estimated  
22 \$6.2 billion through the license application. And the  
23 Congressional expectations were for DOE to streamline the  
24 program to show measurable progress at a reduced cost.

25           So we are moving forward with a restructured

1 program within the existing legislative and regulatory  
2 framework. We think it responds to Congressional  
3 expectations. We think it is consistent with the original  
4 intent of the Nuclear Waste Policy Act, the guidelines, and  
5 10 CFR Part 60 in terms of expectation of amount of  
6 information that would be available, both for the suitability  
7 decision, the license application. It responds to many of  
8 the suggestions from outside the program regards to a more  
9 effective management and a focused technical program.

10           So we basically have begun to implement a program  
11 that recognizes the key statutory and regulatory framework.  
12 There are four key things; whether the site is suitable,  
13 which is a DOE responsibility. If the site is suitable, to  
14 prepare an environmental impact statement, and to recommend  
15 the site for development of a repository to the President,  
16 and if the recommendation is approved, to submit a license  
17 application to the NRC for authorization to construct the  
18 repository. Those are the key goals, and our program has  
19 been planned around those goals. So this five year plan has  
20 chapters on suitability, has chapters on licenses, will in  
21 the future have a chapter on NEPA.

22           So the approach was developed to help ensure that  
23 measurable progress is made towards a DOE decision about the  
24 suitability of Yucca Mountain, there are what we call metrics  
25 in that five year plan, and if the site is suitable, that the

1 program is able to proceed with the EIS, the site  
2 recommendation, the license application, and if approved by  
3 NRC, the construction of a repository.

4           We're trying to emphasize the investigations and  
5 the engineering that are necessary and sufficient to support  
6 a technical site suitability determination in 1998. These  
7 evaluations are based on data collected, calculations, models  
8 intended to provide reasonably conservative estimates of the  
9 range of site conditions and system performance  
10 characteristics. That is our goal in doing technical site  
11 suitability.

12           The DOE decision on technical site suitability will  
13 be based on the technical input and evaluations of compliance  
14 with the guidelines as addressed in the SCP. So we're still  
15 following the strategies as they were laid out in the SCP.

16           The technical program will also provide information  
17 needed to support the decision on overall site suitability,  
18 which in addition to technical site suitability, requires the  
19 guidelines that relate to environmental, socioeconomic  
20 impacts and transportation. That is that four group of  
21 guidelines on that viewgraph that summarized all the  
22 guidelines. It will also support the preparation of the EIS  
23 and the technical program will also support the preparation  
24 of the license application.

25           We've had a lot of questions on how they're

1 related, how site suitability and licensing are related. So  
2 we have a few graphs that try to address that.

3           We have a single technical program that provides  
4 that information for technical site suitability and for  
5 compliance with licensing requirements. We're initially  
6 focusing on technical site suitability and the evaluations  
7 are being performed in a stepwise manner, as will be  
8 described by Jane in a few minutes.

9           The overall site suitability--that's the site  
10 recommendation--will also consider additional information  
11 related to environmental quality, socioeconomic impacts, and  
12 transportation, and those will be evaluated in parallel in  
13 the NEPA process. Again, that's the fourth group of  
14 guidelines on that diagram I showed earlier.

15           As we're evaluating technical site suitability,  
16 we'll also be interfacing with the NRC. We need to do that  
17 first of all so the NRC can provide--they're required by the  
18 Nuclear Waste Policy Act to provide preliminary comments  
19 regarding the sufficiency of site characterization  
20 information for a license application when we submit the site  
21 recommendation report, and also to allow us to be able to  
22 submit a license application that the NRC will find adequate  
23 for docketing. So basically, we don't see any decrease, and  
24 probably an increase of our interactions with the NRC.

25           This is just a diagram that tries to show you how

1 the data collection and the synthesis of that data, which  
2 Jane will talk in great detail, serves not only the  
3 suitability analysis and DOE's decisions on high level  
4 findings, but also serves the regulatory, from the licensing  
5 perspective, analysis and feeding the annotated outline,  
6 helping us with technical exchanges, providing information  
7 for topical reports, and perhaps leading to prelicensing  
8 agreements with NRC staff.

9           The 960 and 10 CFR 60 are not inconsistent. That  
10 language comes from--I don't recall, it's either the  
11 statement of considerations, 960 or 60--somebody can correct  
12 me. 960. So that language, that wording comes out of the  
13 information that comes with 960.

14           The same relationship that is between the siting  
15 program and the licensing occurs between site suitability and  
16 EIS. A single technical program provides the information  
17 needed for site suitability and preparation of the EIS.

18           The technical site suitability, again, I more or  
19 less said all this, but evaluates the areas covered by the  
20 SCP. The EIS will address the areas on the responsibility of  
21 NEPA.

22           So basically, overall site suitability will rely on  
23 the technical site suitability determination, evaluation with  
24 the guidelines related to environmental quality,  
25 socioeconomic impacts and transportation, based on

1 information developed to support the NEPA process.

2           So that's kind of the background on suitability and  
3 some of the history. At this point, Jane Summerson is going  
4 to get up and describe to you our draft process for  
5 evaluating technical site suitability.

6           DR. ALLEN: Steve, since we're a bit ahead of time here,  
7 it might be appropriate to stop and ask you questions right  
8 at this point, if you're willing to break for the moment.

9           DR. BROCOUM: Of course.

10          DR. ALLEN: Are there questions from the Board? Dr.  
11 Cantlon?

12          DR. CANTLON: Cantlon; Board. In connection with the  
13 distinction between the site suitability determination and  
14 the licensing, do you perceive any difference in the level of  
15 data that will be available for those two submissions?

16          DR. BROCOUM: There may be a difference in level of,  
17 first of all, the NRC has--about the level of data for  
18 license application. We have to pay close attention to NRC.  
19 We just had an interaction with them the other day on the  
20 two topical reports, and they gave us very good guidance as  
21 to the level of information they need, first of all.

22                 Second is 960, in a sense, focuses on the site; is  
23 the site suitable. 60 focuses more on the total system. So  
24 it seems that for the license application, you have to have a  
25 lot more design and systems information than you might need

1 to have for the technical site suitability evaluation. So  
2 that's one area that perhaps more data is needed.

3 DR. CANTLON: I gather then from that answer that you  
4 don't perceive any substantial difference in the quality of  
5 the data and the analyses that will be brought in the  
6 geophysical, geological--

7 DR. BROCOUM: No, I don't see a substantial difference  
8 because we're trying to do many of these things in parallel,  
9 as this last diagram showed--it given give the time, but  
10 we're trying to use--as much as possible, we're trying to  
11 have the data collection and the synthesis feed both. So as  
12 we interact with the NRC and understand better their needs,  
13 we will be adjusting this.

14 So I would say in the end, there will not be too  
15 much difference between these two and the earth sciences.  
16 But still, NRC may have some special requirements that, you  
17 know, we may not have, so I don't think you can make an  
18 absolute statement on that issue.

19 DR. ALLEN: Other questions from the Board? From the  
20 Staff?

21 DR. METLAY: Dan Metlay, Board Staff.

22 Steve, as part of your EIS process, do you  
23 anticipate analyzing different technical designs for the  
24 repository?

25 DR. BROCOUM: I would have to turn to an EIS person, and

1 I think there is an EIS--is there an EIS person in the  
2 audience? There was supposed to be somebody here from EIS.  
3 Yes, why don't you come up to a microphone.

4 MR. MC CANN: Ed McCann, Environmental Programs.

5 I believe the question was are we going to look at  
6 several different designs. Was that--

7 DR. METLAY: Alternative technical designs for the total  
8 repository system.

9 MR. MC CANN: We'll look at alternative design features.  
10 There won't be multiple designs of the repository done.  
11 We'll look at different design features as it affects  
12 impacts. We want to focus on the environmental impacts.

13 DR. DI BELLA: Carl Di Bella of the Board Staff.

14 I have a question, a couple of questions actually  
15 about the five year plan that you handed out. One, I notice  
16 that there seem to be no numbers in thumbing through it, that  
17 is, no future funding requirements. Do you intend to add  
18 that at some point? And what is your timing for the plan,  
19 really?

20 DR. BROCOUM: There is a version with the numbers in it  
21 that we're using internally. For release, since it's also  
22 going to be used for our budget for OMB, we decided, so we  
23 can release it sooner, we would release it without the  
24 numbers. Okay?

25 The other point, to make this volume is a part that

1 will eventually be a larger plan called the Program Plan,  
2 which you'll have a first volume which will be an overview  
3 volume, and this will be the second volume, and the third  
4 volume will be the rest of the program. And so that whole  
5 document called the Program Plan will be issued, I'm not sure  
6 what the schedule is at this moment. A lot of that depends  
7 on other parts of the program and getting that Program Plan  
8 done.

9           What we're trying to do here is issue it as early as  
10 we can, what we have, because we've got a lot of comments  
11 from the--called the state assets, at the AUG meeting last  
12 time. So we've issued what we have available. It's going to  
13 change and it doesn't have the numbers, so we could issue it  
14 sooner.

15       DR. ALLEN: Dennis Price?

16       DR. PRICE: Steve, just a question about things we had  
17 heard earlier about the program approach about phased in of  
18 activities such as construction and receipt and emplacement  
19 of waste and so forth as part of the plan of the program  
20 approach, and I'm a little hazy now as to where that sort of  
21 thinking stands.

22       DR. BROCOUM: I would say that's all being thought  
23 about. The concept of operations of the repository; is that  
24 what you're asking? I'm not sure what your question is.

25       DR. PRICE: Well, earlier, there was some discussion

1 about how much do you need to know in order to start  
2 construction and how much do you need to know to be able to  
3 receive and begin to store and so forth.

4 DR. BROCOUM: That will be addressed in large part by  
5 Jean Younker, who is somewhere in the room here, at 1 o'clock  
6 in her talk, what the uncertainties are, what we think we'll  
7 get now, what we might get a little later. That's the third  
8 talk we're going to have today.

9 DR. ALLEN: Bill Barnard?

10 DR. BARNARD: Steve, this may be covered later by Jean,  
11 too. What's the relationship between the technical site  
12 suitability decision in 1998 and any progress that's made on  
13 underground exploration ESF?

14 DR. BROCOUM: It's thought that for technical site  
15 suitability we need to be able to go look at the Ghost Dance  
16 Fault.

17 DR. BARNARD: Is that all?

18 DR. BROCOUM: And Calico Hills, we're still evaluating,  
19 we have a system study to evaluate Calico Hills. The North  
20 Ramp extension, although it's in the five year plan, it's in  
21 the further out years because of budget reasons in that case.  
22 But that's all constantly being re-evaluated. So at the  
23 moment, we're basically looking at a ramp heading south and  
24 looking at some of the faulting at this point in time.

25 DR. ALLEN: Leon Reiter?

1 DR. REITER: Steve, I wonder if you could just step back  
2 for a second and tell us what you mean; what is the DOE going  
3 to be able to say in 1998 when it reaches a technical site  
4 suitability decision? The reason I'm asking this is we've  
5 heard this described at various times as merely an investment  
6 decision. We've heard it described as a very important  
7 landmark. Just give us an idea what do you think it's going  
8 to mean?

9 DR. BROCOUM: Well, I think what we're trying to do for  
10 1998 is tell you our best shot at how we think the site is  
11 based on the information we have. I mean, we will do as many  
12 guidelines as we can. If we can do them all, we will. If we  
13 don't have the information, we won't. But we want to  
14 demonstrate progress at the best pace we can, evaluating the  
15 guidelines in groups, as I think we've said in other  
16 meetings, to give a feeling of what we think about the site  
17 and to let the outside world know and let them participate,  
18 as Jane is going to explain today, in how we think the site  
19 is and let them know what our thinking is.

20 So it's, in a sense, it's an investment decision,  
21 should we go on, do we see anything wrong. You know, it's  
22 something that we have invented, if you like, so we can  
23 demonstrate progress of evaluating suitability. Suitability  
24 finding is I think in the year 2000.

25 DR. REITER: Well, so 1998, you're going to make a

1 statement whether or not you have been able to evaluate--it's  
2 just a progress statement? You say you may not be able to  
3 evaluate all the qualifying and disqualifying conditions at  
4 that point?

5 DR. BROCOUM: I think what we will do is we get and  
6 evaluate each bucket of information. If the peer review says  
7 you don't have all the information you need to have, then  
8 we'll have to go back and reconsider it or collect more  
9 information. It's hard for me to tell you now what we'll be  
10 able to say in 1998. We have a plan, we have a schedule to  
11 go through each of the guidelines between now and 1998.

12 But if for some reason, budgetary reasons or  
13 scientific reasons or peer review reasons or interfacing with  
14 the Board here, the information is not adequate or good  
15 enough to make that finding, we won't make a finding in a  
16 particular area. We will have to delay it. I mean, I  
17 personally don't see a problem with that.

18 DR. REITER: Okay. So this is really an important  
19 point, because you're saying that the schedule is not  
20 critical. What's critical is the ability to make a statement  
21 about site suitability. Am I reading you correctly?

22 DR. BROCOUM: I mean, we have a schedule. You need a  
23 schedule to run the program. But if we don't--surface  
24 processes are something that Jane is trying to make next  
25 year. To make that finding next year, she has to do a

1 million things, which she's going to explain to you today in  
2 detail. If she can't get those things all done, we won't be  
3 able to make a finding on surface processes. We'll have to  
4 make it later.

5           So if you ask me what's more important, the  
6 technical finding or the schedule, it's the technical  
7 finding.

8       DR. ALLEN: Dr. Dreyfus I think had a comment here.

9       DR. DREYFUS: I think maybe I should have something to  
10 say about this.

11           The situation basically is at a level, people would  
12 like us to make the technical site suitability finding  
13 tomorrow morning. They wanted me to make it a year ago. I  
14 had a very, very long dialogue with the Congress one day that  
15 lasted two hours and 15 minutes on do we or do we not think  
16 that this site is going to work.

17           Now, there are a lot of ways to look at that. One  
18 way to look at it is say we'll let you know that when we get  
19 the answer from the Nuclear Regulatory Commission in two  
20 thousand and whatever, five, six, time frame. But I don't  
21 think it will wash. We are out there, and as the Department,  
22 we have got a decision to make. The Secretary must make a  
23 decision whether to recommend this site at an earlier time  
24 based on basically the technical aspects of the situation.

25           What we have done is basically contended that by

1 the '98 time frame, we would expect to have enough technical  
2 information to be able to make a statement that, yes, we  
3 think we do, or no, we think we do not have a good site  
4 technically to present to the Commission, which gives the  
5 world, the policy world, some notion of how long they've got  
6 to wait before they know whether we have found some disabling  
7 situation with the mountain.

8           Now, of course, we could find some critical fault,  
9 some critical problem earlier, but at some point, you take  
10 what you've got and you say I think it's okay. And we did  
11 that, as Steve said, a long time ago, based on various  
12 superficial data. We made a statement, yeah, right now, from  
13 what we know, we think it's okay.

14           This one would be more profound because at this  
15 point, we presumably will have looked at all of the things  
16 that we now expect to be critical, and we'll say we think we  
17 have a site.

18           Now, there are many reasons why that's important.  
19 One is because there is a tremendous amount of investment  
20 beyond that time in the regulatory process. So it's  
21 appropriate for us to give the President and the Secretary  
22 and the NRC and Congress and the public some idea where we  
23 stand before we engage them all in that kind of a policy  
24 debate. And this is basically the jumping off point; from  
25 the '98 time on, you're beginning to essentially engage the

1 policy process, decision making, and it's I think appropriate  
2 now.

3           How profound is it? It's not in the Act, so it's  
4 not a statutory requirement. But it's an end point that we  
5 can utilize to gauge convergence of all these processes into  
6 something that the world can address. It's also a sooner  
7 time to declare failure if at that point we say we don't  
8 think we have a sufficient probability of licensing to go  
9 forward. That's what it is. It's important, but it's not  
10 very profound. Until that time, we're probably going to be  
11 working on piecemeal data and unwilling to make definitive  
12 statements about the probability of success.

13       DR. ALLEN: I think in fairness to Jane Summerson, to  
14 give her adequate time, we ought to move ahead. We can come  
15 back to some of these same questions either following your  
16 talk or later this afternoon.

17           So the next presentation, or part of the same  
18 presentation, is by Jane Summerson.

19       DR. SUMMERSON: Am I audible in the back? I have never  
20 had to use a mike before because my voice projects. So if  
21 I'm too loud, please let me know.

22           I'm Jane Summerson. I work for Steve Brocoum here  
23 at the Yucca Mountain project, and I'm the team leader in  
24 charge of the site suitability evaluation.

25           What I want to talk about today is the process that

1 we are involved in. It's a process to develop a process of  
2 evaluation. It's a very sincere effort to get the public  
3 involved, to get the program involved, to get the  
4 stakeholders involved in working out a method of evaluating  
5 and of documenting our evaluations that people are  
6 comfortable with.

7           We're going to be looking at a quick review of the  
8 situation on the siting guidelines, and then an overview of  
9 the process in its draft form right now. Our public comment  
10 period ends in just a couple of days. We are already in the  
11 process of revising according to a number of the comments  
12 that we've gotten, and we still expect to be finalizing this  
13 process by November 15th.

14           In terms of the siting guidelines, Steve gave  
15 background. When I came into this position, a task force had  
16 been set up at the project to look at a range of options  
17 concerning application of the guidelines. And we expanded  
18 it, a little bit from talking to the affected units of  
19 government at their recommendation when they pointed out to  
20 us that this was a national issue, to a national comment  
21 period on the application of the guidelines.

22           The comments that we received did not reflect a  
23 clear consensus. They covered the spectrum of "do  
24 everything" to "do nothing", and the reasons were very  
25 varied. And so it wasn't clear cut oh, gee, all of our

1 stakeholders think we should do "X" so we should do "X". It  
2 pretty much left us with all of the debates that we had to  
3 begin with.

4           There were a number of issues raised concerning  
5 rulemaking. At one point, some of our commenters said that  
6 the guidelines are not applicable to a single site. Steve  
7 made some references to this. Our counsel disagrees with  
8 that. They feel it's very clear that the guidelines can be  
9 applied to a single site. In fact, the precedent has been  
10 set in the EA, for Yucca Mountain, and the SCP.

11           Another comment suggested a rulemaking as a means  
12 to clearly define the role of the public. The role of the  
13 public--the very important role of the public in this process  
14 is mandated in the Act, and we felt that if we involved a  
15 rulemaking in this also, we would, in a sense, be tying our  
16 hands because this is a learning process for us. And I've  
17 already made a number of mistakes, and I've had to back up  
18 and make changes in how we're involving the public, and I  
19 think we're going to continue to do that in the next few  
20 years, and if we had a rulemaking that tied our hands to  
21 something that turns out is a mistake, then we would not be  
22 able to be as responsive to the needs of the public as we  
23 want to be.

24           There was suggested a need to be consistent with 10  
25 CFR Part 60. Well, it's required in 960 that it be not

1 inconsistent with 60, and the NRC has already concurred in  
2 that. So, again, we didn't see that one as being compelling.

3           And then an opposition to the idea of rulemaking  
4 was expressed by a number of commenters, the concern that  
5 this would be taken as an opportunity to tailor the  
6 guidelines to guarantee that Yucca Mountain was found  
7 suitable and make it an easy solution for this national  
8 problem.

9           We concluded in our analysis that there was not a  
10 compelling justification to go forward with the rulemaking,  
11 and we did share the great concern that without that  
12 compelling justification, it would be seen or perhaps even an  
13 attempt would be made to use it to tailor the guidelines to  
14 guarantee Yucca Mountain was chosen, which would not be  
15 serving the best interests of this country.

16           Therefore, Dr. Dreyfus made a decision that we  
17 would go with the guidelines as they are currently written.  
18 This is, of course, subject to the statutory changes that  
19 have been made and would be consistent with the approach  
20 discussed in the SCP, and Steve went into that in some detail  
21 earlier.

22           And as he said, we will be re-examining. We had  
23 assumed, although I do not think we expressed it well, that  
24 we would implicitly address the favorable and potentially  
25 adverse conditions, and we will be going back and reviewing

1 with counsel to be sure that what we are doing is consistent  
2 with the guidelines as they stand in response to a number of  
3 comments that we have received.

4           Now, I'd like to move on to an overview of the  
5 process as we're developing it now. For people who find  
6 graphics easier to follow than lots of bullets, this process  
7 has basically three components; development and review of the  
8 technical basis, development and review of a guideline  
9 compliance assessment, and a number of Department of Energy  
10 findings or decision points that have to be made and  
11 documented. And these are interim, the diamonds represent  
12 interim DOE decisions. And what I'll do is to discuss each  
13 of these boxes in more detail.

14           As an overview of the process and sort of our  
15 general goals when we first started drafting it, the  
16 characteristics, we wanted it to be open and sequential. We  
17 wanted to have evaluation of the individual guidelines or  
18 groups of guidelines scheduled according to when the  
19 information, the analyses and the designs become available to  
20 try to make things as efficient as possible. We want to  
21 ensure that we have formal and recognized predecisional  
22 public input at a number of points along the way.

23           We want to have timely information and analyses for  
24 the DOE managers to make the very important decisions that  
25 they need to. We need to document the evidence and rationale

1 for these decisions so that in the future, if the individuals  
2 are not around who have been involved in this, we do have an  
3 adequate record so that they can be understood. And we have  
4 a goal to clearly separate and make a distinction between the  
5 technical information and the evaluation of that technical  
6 information and an assessment of adequacy to support a DOE  
7 management decision.

8           As I mentioned in the graph, this process has three  
9 main elements; the development and review of the technical  
10 basis, the development and review of the compliance  
11 assessments, and the various decisions that the DOE managers  
12 have to make based on the evidence that we are collecting,  
13 analyzing and documenting for them in this process.

14           So first we'll look at the technical basis. The  
15 general considerations; first of all, the data needs for each  
16 technical basis report are defined or derived by looking at  
17 the guidelines.

18           The DOE makes the evaluation of "we should probably  
19 know this to demonstrate compliance with this guideline, and  
20 these are the tests that need to be done". Obviously, the  
21 first and overwhelming step in this was the site  
22 characterization plan, but that is a huge document, that it  
23 was always assumed that as we learned more, we would be able  
24 to focus more on the important issues and the more important  
25 data needs. And so that is what the technical part of the

1 suitability group is looking at right now, is more  
2 specifically what data needs we have for each of these  
3 guideline assessments.

4           We are focusing at this point on the technical  
5 guidelines covered in the SCP. Those are the basis for this  
6 technical site suitability decision. Those are the post-  
7 closure related to waste isolation and pre-closure related to  
8 rad. safety and technical feasibility.

9           In separating this technical basis, this will help  
10 facilitate the technical review, independent peer review that  
11 we're negotiating with the National Academy of Science right  
12 now to manage for us.

13           These technical basis reports will discuss the  
14 available data analyses, present a current understanding of  
15 the subject area, and this includes the uncertainties,  
16 credible alternative models and interpretations, bounds on  
17 the conditions and processes consistent with the current  
18 understanding.

19           Each technical basis report will have an executive  
20 summary written for the lay person, and each one we expect at  
21 the present will be peer reviewed by the National Academy of  
22 Sciences. Now, that is a slight change. The original draft  
23 went out of this process saying we would ask the Academy to  
24 decide which ones should be peer reviewed. A number of  
25 commenters had problems with that, ranging from it's way too

1 cumbersome and complicated to then you have just another  
2 decision of whether something is going to be evaluated or  
3 not, why don't you just do them all.

4           And one of the first reactions to comments we had  
5 was to discuss it with the managers, and Steve and Dr.  
6 Dreyfus supported we will simply peer review each technical  
7 basis report, and that way we can plan right now, knowing how  
8 many we're going to have, what the subjects are, and it will  
9 actually simplify the management of the process and ensure  
10 that all of our technical material gets analogous treatment.

11       DR. ALLEN: I might just point out that it's--I assume  
12 it's actually the National Research Council, which is a group  
13 made up of the National Academy of Sciences, the National  
14 Academy of Engineering, and the Institute of Medicine. So  
15 it's not just scientists; there are engineers involved as  
16 well on these peer review groups.

17       DR. SUMMERSON: Let me see now. I am still confused by  
18 all of the acronyms in that organization, but the procurement  
19 will be with the Board of Radioactive Waste Management to  
20 manage it according to the National Research Council's peer  
21 review policies.

22       DR. ALLEN: That's right. I just point out that the  
23 National Research Council is made up of more than the  
24 National Academy of Sciences. It also includes the National  
25 Academy of Engineering, which I think is important in

1 visualizing what that peer review might consist of.

2 DR. SUMMERSON: Thank you.

3 To enlarge a little bit on what Steve had said  
4 concerning the guidelines on environmental quality,  
5 transportation and socioeconomics, they are not going to be  
6 evaluated before the technical site suitability decision.  
7 They will be evaluated in this type of process, but the  
8 technical basis reports for those guidelines will be based on  
9 the same database that is developed and used in the NEPA  
10 process and developing the draft EIS, and we will be  
11 coordinating the timing of our process of evaluation of those  
12 guidelines with the NEPA process to ensure that our work in  
13 no way prejudices or interferes with the valid and complete  
14 NEPA process.

15 And so we can't be as definite on scheduling and  
16 plans on those particular guidelines as we can on the  
17 technical ones, because we're holding back to hear from the  
18 NEPA people what is going to work best with them. But we are  
19 coordinating with them. Our findings will be made in  
20 coordination with that group.

21 And the distinction we have made between a  
22 technical suitability decision and an overall suitability  
23 decision is that we can't really make an overall suitability  
24 decision until all of the guidelines in 960 have been looked  
25 at, including these NEPA related ones. And so it's simply

1 that the overall decision can be made once we have completed  
2 the process for those in conjunction with the NEPA process.

3           Now, the peer review aspect of this, and this has  
4 been a subject of great interest. Our main goal in using  
5 peer review is to ensure the quality of our technical work.  
6 I think that is the key goal in using an independent  
7 technical peer review.

8           We're also interested in building scientific  
9 consensus and in helping to improve public trust and  
10 confidence. But the first goal is to ensure the quality of  
11 our technical work.

12           After concerns expressed by a number of our  
13 stakeholders at the meetings we had on the type of peer  
14 reviews that the National Academy has managed in the past, we  
15 have agreed to publish our draft work scope and take comments  
16 on the draft work scope. I will say that in drafting that  
17 work scope, we have paid a great deal of attention to the  
18 written comments we have already received on this subject,  
19 and I think we have managed to address all of them. I'm  
20 hoping we have. But certainly we will find out in our public  
21 comment period.

22           At the moment, we are assuming that the procurement  
23 will go through and that the NAS or BRWM, I guess, of the NAS  
24 will select the peer review panel, manage the peer review,  
25 and oversee the development of the peer review report. The

1 size of the panel and the duration of the review will be up  
2 to the NAS and will be based on the complexity of the  
3 technical basis report that they are reviewing. There is a  
4 time limit and a maximum number that they have agreed that  
5 it's reasonable to work within so that we can plan our  
6 schedule.

7           In selecting the peer review panel--I should add a  
8 little caveat. I am using the same viewgraphs basically that  
9 have been used at the other public meetings because I don't  
10 want to put out written material suggesting that decisions  
11 have been made until our comment period closes. However,  
12 some of these things have developed further along and I am  
13 going to be enlarging on them orally as to where we think we  
14 are in the developing of this process.

15           So what we are talking to the NAS about doing is  
16 setting minimum technical and experience professional  
17 requirements in areas of expertise that are necessary to  
18 review a certain technical basis report. They would publish  
19 these and request nominations from the public of individuals  
20 who qualify under these minimum qualifications.

21           In the selection of the slate of peer reviewers, we  
22 are asking that the Academy pay attention to minimizing the  
23 potential for bias, certainly to be concerned about  
24 individuals who are salaried by one or another of the chief  
25 players in this program, something of that sort; to ensure

1 that diverse scientific views are represented. Obviously  
2 from a management point of view, we have to be aware of the  
3 timely availability of these reviewers, and in direct  
4 response to concerns of our stakeholders, we are asking them  
5 to consider as much as possible geographic sensitivities,  
6 especially the unique concerns of the citizens of Nevada, and  
7 minority representations, and to be able afterwards to  
8 address the public on how they responded to these issues.

9           Now, certainly if it's not possible to find a woman  
10 of a certain expertise, then there won't be any women, but we  
11 would ask that they say we looked for a woman, we could not  
12 find a woman, no woman was nominated. We did try to address  
13 the concern. We were unable to. And that actually is  
14 something that they have been doing in at least the last  
15 couple of reviews that they have done anyway. We are simply  
16 making it explicit in the work scope and asking them to be  
17 open so that it is a transparent process to the public.

18           The management of this peer review must provide  
19 opportunities for public observation of interaction between  
20 the peer review panel and the authors. And, in fact, what  
21 they normally do, and will certainly be doing in this  
22 process, as I think many of us have seen in the 801 study, is  
23 soliciting technical presentations and written information  
24 from the public that the peer review panel should take into  
25 account. And there will be at least one meeting where the

1 public, and we certainly would hope that the public includes  
2 our oversight groups, our regulators, our stakeholders, would  
3 give technical presentations on issues that they feel are  
4 important and should be addressed in this peer review.

5           We're also requesting information from the public.  
6 It is a requirement of the Academies, and one that we  
7 certainly agree with, that any written information that is  
8 given to the panel by anybody, including the Department, has  
9 to be made available to the public.

10           We're asking that the reviews focus on evaluating  
11 validity of data and interpretation and adequacy given to  
12 technical uncertainties in describing the current state of  
13 understanding.

14           The report should address at least these technical  
15 issues. I don't think I need to read them through. You can  
16 all see what they are. But the intent is to make it focused  
17 on the quality of the technical work, of the science that has  
18 been done. And we are asking that the report include  
19 documentation and discussion of external technical issues  
20 that have been presented to the peer review panel that for  
21 one reason or another have not been included as one of their  
22 recommendations, again, in order to help make the scientific  
23 evaluation more transparent to the public.

24           And the draft work scope, which as soon as it gets  
25 through concurrence should be published for comment, I

1 believe, we've certainly put a lot of hours into trying,  
2 actually incorporates all of these concepts in it. And the  
3 people we're working with at the Academy are very comfortable  
4 with what we're saying at this point.

5           Now let's go on to the guideline compliance  
6 assessment. After we get the peer review report back from  
7 the National Academy, certainly if it comes back and says you  
8 really ought to do X, Y and Z test, it will reduce this  
9 uncertainty here and this uncertainty here, so that you have  
10 a much firmer grasp of this understanding. Then we need to  
11 re-evaluate our situation and our test program and consider  
12 the steps, there is a feedback group in the testing program,  
13 and gather more data.

14           If it's felt that we have a strong technical basis  
15 to go forward with the guideline compliance assessment, then  
16 the next step is for our team to put together this  
17 assessment. Now, this repeats a little bit what Steve said,  
18 but we have to ultimately make a higher-level finding for  
19 each qualifying and disqualifying condition. That finding  
20 requires an assessment that the qualifiers are present or  
21 that the disqualifiers are not present, and that the  
22 conclusion is not likely to change even if we continued to  
23 collect more data.

24           Our compliance assessment will be written based on  
25 the technical basis report that we produced, and the external

1 review of that technical basis report.

2           The compliance assessment will be the DOE staff  
3 analysis of that technical data and other data such as design  
4 information, that type of thing, that is relevant to a  
5 particular guideline condition. We'll present our compliance  
6 arguments. It will contain recommendations to the director  
7 for a guideline finding, because a higher-level finding can,  
8 after all, be either positive or negative, and it will  
9 comprise a part of the basis that the director will use to  
10 make the decision on the higher level finding.

11           Once we've produced that draft, we'll publish a  
12 Federal Register notice and, of course, as always do our  
13 regular mailing to let our stakeholders who have requested  
14 information know that the guideline compliance assessment,  
15 the technical basis document and the peer review document are  
16 available for public review and comment.

17           We will hold, during the comment period, public  
18 workshops to discuss the compliance arguments and the  
19 concerns of the public. At the end of the comment period,  
20 the compliance assessment may be revised based on those  
21 comments. In any case, an external review summary will be  
22 developed that documents all of the comments received and our  
23 responses to them, and that record will be a part of the  
24 formal decision package so that all comments will be  
25 available to the director to consider when he makes his

1 decision.

2           Now, the DOE decisions. The first ones will be the  
3 series of higher-level findings. The director will have to  
4 accept or reject the case for higher-level findings based  
5 primarily on the record that we're developing in this  
6 process; the final technical basis report, the peer review  
7 report, guideline compliance assessment, external review  
8 summary of all of the comments that we have received in our  
9 public comment period, any response we have to these  
10 comments, and other information as appropriate. And those  
11 words "other information as appropriate" come from the Act  
12 relating to the body of information that the Secretary uses  
13 for her decision, and we felt that it was appropriate to  
14 include this for the director as well.

15           Notice of the director's decision and a rationale  
16 for that decision will be published once the decision is  
17 made.

18           We've said several times that a favorable higher-  
19 level finding requires a judgment that no new information is  
20 likely to change the conclusion. However, it is conceivable  
21 that new information could be developed that requires a re-  
22 assessment of a higher-level finding. If this should happen,  
23 this information should be brought to the attention of the  
24 director as soon as possible so that the director can take,  
25 and the program can take, appropriate steps.

1            Technical site suitability decision is based on the  
2 evaluation of site conditions and design concepts. And that  
3 involves a higher-level finding on all the guidelines that  
4 are addressed in the site characterization plan, and that is  
5 a decision that is made by the director of OCRWM. That is a  
6 program decision.

7            The overall suitability decision is also a program  
8 decision. The director then at this point will have made the  
9 additional findings on the NEPA related guidelines, so that  
10 findings at the time that we say an overall suitability  
11 decision has been made by the director, what we're saying is  
12 all of the guidelines in 960 have now had higher-level  
13 findings made.

14           Now, if at any time the site is found to be  
15 unsuitable in this process, we are required by the Act to  
16 submit an alternative plan to Congress within six months of  
17 an unsuitability decision.

18           The final agency action, the Secretarial decision,  
19 is the site recommendation to the President of the United  
20 States. And that recommendation is going to be based on the  
21 overall suitability finding that our director has made based  
22 on all of the documentation and the records that we've  
23 produced in this process, the final EIS which our NEPA people  
24 will have produced, input from the NRC and stakeholders as  
25 required in the Act, and other relevant information, as

1 required in the Act.

2           Those are the three major DOE decision points, and  
3 that's my formal presentation. I'll be glad to answer  
4 questions.

5           DR. ALLEN: Thank you, Jane. Questions from the Board?

6           DR. LANGMUIR: Jane, I want to bring you back to the  
7 peer review process, and what comes to mind there is, as I  
8 understand it, you're going to ask the Academy groups to  
9 review individual topic areas separately and report on them.  
10 It also I think in the document you presented us suggests  
11 that the Academy put this together, an Academy report.

12           Is the Academy then being asked to integrate all of  
13 this? I'm concerned that individual groups will not be able  
14 to evaluate by themselves the significance of what they're  
15 doing with regard to the whole suitability issue without  
16 seeing the other reports, because everything is tied  
17 together, of course, and as a system, it's how do these  
18 things fit together that determines suitability.

19           I'm asking you several things, but is the Academy  
20 being asked to integrate it all when the individual reports  
21 have come in to them?

22           DR. SUMMERSON: We are not asking them to bring together  
23 at a later time all of the separate peer review panels and  
24 produce another report integrating, a separate action of that  
25 sort. But the final peer review that is scheduled will

1 actually have an interim and a final that would look at the  
2 total system performance and involves integration of all of  
3 the aspects, because our system guideline involve the  
4 performance of the whole site. And so that is where we see  
5 this overall integration taking place.

6 DR. LANGMUIR: But the Academy will not be doing any of  
7 the integrating themselves in what they provide to you? This  
8 will only be done--

9 DR. SUMMERSON: Their review of our total system  
10 performance assessments and other evaluations of the whole  
11 system and performance of the whole site, they will review  
12 that as a unit. And so I would fully expect they will be  
13 commenting then on how well we've integrated all of these  
14 factors and if we're evaluating them and analyzing them  
15 appropriately.

16 DR. ALLEN: Incidentally, Chris Whipple may be present.  
17 He's the chairman of the Board of Radioactive Waste  
18 Management. He might have some comments.

19 DR. SUMMERSON: I haven't spoken to Chris. I have been  
20 dealing with Carl Anderson and Ina Alterman. But they have  
21 been very actively involved in writing up and drafting this  
22 work scope and have been very helpful in how we have phrased  
23 the type of technical issues.

24 DR. ALLEN: Having been myself involved in many NRC  
25 projects as well as report reviews, how does the time

1 schedule work out? Do you expect all this to be done within  
2 two or three years?

3 DR. SUMMERSON: I have been assured that--my own staff,  
4 I have a little more trouble with Carl and Ina--I have been  
5 assured that they have a track record for running on this  
6 scale reviews and getting them turned around and in on time,  
7 they feel that a four to six month time period, as long as  
8 they have a long lead time, knowing what the subjects are, so  
9 that for instance they could start impanelling now peer  
10 reviewers for several years down the road, that they can give  
11 us the four to six month turn around, depending on the  
12 complexity.

13 DR. ALLEN: Well, I hope so. But I just point out that  
14 one of the criteria for setting up the panels is that they  
15 include diverse viewpoints. But nevertheless--

16 DR. SUMMERSON: You have put your finger on my biggest  
17 headache--well, my biggest headache right now is just getting  
18 it through procurement so we can even get started for the 95.  
19 We're trying to walk the line between meeting the schedule  
20 pressure, but being sure it is done in a valid, technically  
21 valid and transparent for the public way. Everybody involved  
22 is working towards that goal.

23 DR. CORDING: Ed Cording here, just to follow up on  
24 that. When do you see the first reports, the bulk of the  
25 reports being given to the NRC? At what point, in terms of

1 time, two years from now?

2 DR. ALLEN: The NRC being the National Research Council.

3 DR. CORDING: I'm sorry, yes, National Research Council.

4 DR. SUMMERSON: Actually, the NRC and the NRC will be  
5 getting it at the same time.

6 DR. CORDING: I meant the Academy.

7 DR. SUMMERSON: Right now, we are looking at getting the  
8 first technical basis report to them the 1st of February.  
9 And it will be released to the public at the same time, and  
10 of course the other NRC would get it then as well.

11 DR. BROCOUM: I just want to amplify one thing you said  
12 about the schedule. We started thinking about how to do peer  
13 reviews a while ago. I talked to Myron Uman, who was then  
14 the staff--and he told me that they were able--the National  
15 Academy was able to run two dozen more or less simultaneous  
16 reviews and complete them on schedule for the NIST, National  
17 Institute of Science and Technology, I guess is what the  
18 acronym is today, and so they are confident they can do this,  
19 given the conditions, that we meet the conditions in terms of  
20 lead times and everything.

21 DR. CORDING: But the more contentious the issue, the  
22 more likely they are to have minority reports, the sort of  
23 thing that delays the whole review process, is all I'm  
24 pointing out.

25 DR. BROCOUM: I mean, you know, I think that's a valid

1 technical issue.

2 DR. BREWER: Garry Brewer. The whole point of being  
3 contentious here is something that you can't ignore. The  
4 Committee on Nuclear and Alternative Energy, the CONAES  
5 Report, which was probably in terms of scope and lack of  
6 clarity and conflict about the same size as this, was 30  
7 months late. And, I mean, you can't just presume that  
8 because some staffer in the National Research Council tells  
9 you that they're going to meet the schedule, that it's going  
10 to work, because it isn't going to work.

11 DR. SUMMERSON: I think we're all aware of the potential  
12 dislocations and that sort, but I don't think that's a good  
13 reason to not do the best possible technical peer review of  
14 the work. We just, as I say, all have to do our best to make  
15 it work and have contingency plans.

16 DR. BREWER: Well, there's another part to this. I have  
17 a couple of kind of followups that are related to this. One  
18 of your slides said that you're trying to eliminate bias or  
19 minimize the bias. But the whole NRC process is one that  
20 seeks balance, and that means diverse and often quite  
21 disparate points of view. They seek balance in their boards,  
22 panels and committees, and one of the consequences of seeking  
23 balance, as Clarence rightly pointed out, and all of us have  
24 been on these boards and committees in one form or another,  
25 is that you run the risk, and in this case it's almost a

1 certainty, that you're going to get minority and dissenting  
2 views.

3 DR. SUMMERSON: Absolutely. We realize that. We didn't  
4 put in there that we want diverse scientific views  
5 represented. What we were referring to in bias was the  
6 concern that a number of people have expressed that a DOE  
7 contractor, someone who is salaried in regards to this  
8 program--

9 DR. BREWER: That's a conflict of interest as opposed to  
10 a bias.

11 DR. SUMMERSON: Okay, then we should change our words.

12 DR. BREWER: Yes, you certainly should.

13 Now, there's another part of this. You know, a  
14 peer review is fundamentally one form of expert judgment  
15 about matters that are hard to figure out, I'd say on a good  
16 day.

17 In 1992, there was an expert judgment workshop that  
18 we very much encouraged DOE to do, and that's another form of  
19 expert judgment and there's been no sort of discussion in the  
20 morning's presentation, in spite of our invitation for you to  
21 do so, on how you propose to use other forms of expertise,  
22 particularly since the scope of the activity, by definition,  
23 by what you're doing in the PA, is going to be greatly  
24 reduced. You're not going to be able to provide as much  
25 information in terms of data. You're going to have to rely

1 much more on experts and their judgment, and we haven't heard  
2 a thing about that and I'd just like to put that in the  
3 record. At some point, we should probably follow up.

4 DR. SUMMERSON: Well, if I haven't taken all of his  
5 time, Steve has the rest of the presentation. He's  
6 addressing the other uses of expert judgment.

7 DR. BREWER: Yeah. One of the issues here, and I will  
8 stop using everyone's time, if you reduce the scope of  
9 activity once you are able in terms of the simple logic of it  
10 to present to the National Academy of Sciences, the NRC, will  
11 be less. And so they will be looking at less and making  
12 judgments according to their process, which is a very  
13 elaborate one, about less information. It's very much like  
14 the Sherlock Holmes story of the dog that didn't bark. You  
15 know, there's less barking going on here, and what you give  
16 them is a very reduced scope of possible information, just  
17 the logic of it. How do you account for that?

18 DR. SUMMERSON: I'm not sure I can account for that, but  
19 I mean, yes, what you're saying is correct, and if they don't  
20 think that the less that we present them supports the matters  
21 of interpretation, they'll tell us so.

22 DR. BREWER: Let me be more specific. Will there be  
23 some sense of the scope of activity in terms of what was  
24 going on in the SCP and up until this program approach, and  
25 the reductions that have occurred in terms of what you then

1 present to the National Academy of Sciences? Because they  
2 can pass judgment on what they're handed and say yes, this is  
3 okay, but are you going to give them the opportunity to  
4 comment on what's not there?

5 DR. SUMMERSON: They have expressed that they do not  
6 want to be asked if we asked the right questions or defined  
7 the correct test program.

8 DR. BREWER: So someone's got to do that.

9 DR. SUMMERSON: That is what happens during the  
10 guideline compliance assessment, and that is open to all  
11 stakeholders and the public to tell us if it's not enough.

12 DR. BREWER: Okay, thank you very much.

13 DR. ALLEN: Dr. Dreyfus, did you have a comment on this?

14 DR. DREYFUS: I think it happened.

15 DR. ALLEN: Okay, other questions from the Board?  
16 Staff? Bill Barnard?

17 DR. BARNARD: Bill Barnard; Board Staff.

18 Jane, both you and Steve are earth scientists. I  
19 was just wondering if there are any technical areas related  
20 to site suitability that you think are going to be tougher to  
21 deal with than others.

22 DR. SUMMERSON: Well, of course, I mean hydrology, let's  
23 be honest.

24 DR. BARNARD: Is that the only one?

25 DR. SUMMERSON: I wouldn't say it's the only one, but I

1 think it's heads and shoulders above the others.

2 DR. ALLEN: Other questions from the Board? Staff?

3 From the audience?

4 MR. MC QUIRE: Robin McQuire, Consultant.

5 Jane, do you have a list of the technical basis  
6 reports that you anticipate will be submitted to the NRC and  
7 the dates scheduled for them?

8 DR. SUMMERSON: I don't have it on me. It's in the  
9 draft work scope, which hopefully will be going out any day  
10 now. And I think the Waterfall diagram--

11 DR. BROCOUM: The Waterfall diagram was presented  
12 several times to the Board, and I believe during the--also  
13 that we gave out this morning.

14 DR. SUMMERSON: Now, it's still draft. We're still  
15 working it with the site data collection people in terms of  
16 when data is coming in, and some changes will certainly  
17 continue to be made through the years.

18 DR. ALLEN: Other questions?

19 MS. TREICHEL: Judy Treichel, Nevada Nuclear Waste Task  
20 Force.

21 We were told at least once, and possibly more, at  
22 meetings that were held here in Nevada that there was a big  
23 connection between the peer review process with the NAS and  
24 public trust and confidence, that that was really one of the  
25 ways that you were headed toward trying to build that. And

1 we were told that we would be able to see--that the public  
2 would be able to see the scope and terms of the contract  
3 before it was finalized. Will that happen?

4 DR. SUMMERSON: Yes. As soon as I can pry that loose  
5 from concurrence at headquarters, it's going in the Federal  
6 Register and it will be sent to everyone who has been  
7 attending these meetings and expressing interest, and we will  
8 be asking for comments before it's finalized.

9 MS. TREICHEL: Okay.

10 DR. SUMMERSON: Although I did use your written comments  
11 when I met with the procurement people to help draft it. So  
12 I hope I've been addressing the concerns. But absolutely,  
13 it's a matter of getting it through concurrence.

14 MS. TREICHEL: Well, that was what we suggested, that we  
15 wanted to see how it all came out. Okay.

16 DR. SUMMERSON: Absolutely.

17 MS. TREICHEL: Thank you.

18 MR. BLANCHARD: Max Blanchard.

19 Jane, I'd like to ask just one question, and that  
20 is it seems like some of the processes that have been used in  
21 the past in the program have had difficulty getting out of a  
22 loop in the cycle and it looks to me like one of the  
23 difficult parts of this approach subjects the cycle to a  
24 closed system to where you can't get out of the loop with  
25 respect to receiving comments through the peer review process

1 where in each guideline, the situation could develop where  
2 there's a minority opinion. The minority opinions that would  
3 be published along with that report would be advocating yet  
4 additional information and analysis and more site  
5 characterization, and it wouldn't be surprising that  
6 something like that would develop in a process like this.

7           Have you given thoughts about how you would be  
8 dealing with that, which would then cause you to go into  
9 another five year cycle of site characterization?

10          DR. SUMMERSON: The work scope requests that any  
11 suggestions for additional testing or gathering of additional  
12 data be explicit about exactly what uncertainty those tests  
13 would be expected to address, so that the DOE managers have a  
14 valid basis for their decision on whether to accept or reject  
15 that recommendation. Ultimately, it is a DOE management  
16 decision of the level of risk they want to take and the  
17 argument they want to take on showing compliance.

18          MR. BLANCHARD: Okay. So are you saying that in your  
19 report to the National Academy of Science review groups that  
20 there will be a section in there addressing uncertainty which  
21 will allow everyone to decide whether or not the uncertainty  
22 is supported by technical analysis?

23          DR. SUMMERSON: Max, I'm not sure I want to say in every  
24 report, because I haven't been involved in drafting the  
25 outlines for every report. But I would think that

1 uncertainty, technical people, is going to have to be  
2 addressed in every one of the technical bases, yes.

3 MR. BLANCHARD: Yeah. Well, the uncertainty analysis  
4 would go a long ways--

5 DR. SUMMERSON: You know, other than the one of is it  
6 located in a national park or something like that. But, yes,  
7 they have been specifically requested, as I said, that any  
8 recommendation for additional testing that is made needs to  
9 be tied to a specific issue and an uncertainty as to how that  
10 uncertainty will be reduced or what question it will answer,  
11 not just a gee, it would really be nice if we knew something  
12 about whether the moon is green cheese or not. We need to  
13 know exactly, the DOE managers who make the decisions need to  
14 know exactly what would be accomplished by additional  
15 testing. And then it's their decision.

16 DR. ALLEN: Carl Johnson, did you have a question?

17 MR. JOHNSON: Carl Johnson with the State of Nevada.

18 Jane, I was very disappointed in your response to  
19 Garry Brewer's question relative to the request of the  
20 NAS/NRC for any comments they might have as a result of their  
21 review relative to changes in scope of a particular study,  
22 report or whatever.

23 It sounded to me like from your response in that,  
24 you're not going to request the Academy to do that. Then  
25 it's going to fall onto the rest of us as stakeholders to

1 provide that information to some I think unknown or  
2 unidentified organization at this point, because it appears  
3 like the NAS process will essentially be a closed process for  
4 outside comments or consideration of reports, documents or  
5 whatever that have not been provided specifically by the  
6 Department. I don't know where we as members of the  
7 stakeholders doing our technical evaluation of the site,  
8 where we fit into that system.

9 DR. SUMMERSON: If I implied in my answer to Dr. Brewer  
10 that the NAS process would be closed to technical  
11 considerations by the stakeholders, I did not mean to do  
12 that. I meant--what I was trying to say was we are not going  
13 to present them with a technical basis report and the SCP and  
14 say tell us if we, you know, did everything we should have  
15 done from this vast menu.

16 But the peer review process--before the peer review  
17 starts, the public will be, well, first of all, to nominate  
18 peer reviewers, but also to submit any technical information  
19 that they feel would be relevant on technical issues, to  
20 raise technical issues that they feel we have not addressed  
21 or raised, and in the opening, at least one and however many  
22 are deemed necessary, meetings with the public, that peer  
23 review panel will be soliciting presentations on technical  
24 issues that it is felt have not been covered by the DOE in  
25 our technical basis report. And you will have had that

1 report for not a great period of time, but certainly a month  
2 anyway, that would, you know, help you to make those  
3 presentations.

4           So I don't want to second guess and tell the panel  
5 I think our stakeholders are going to be concerned about X, Y  
6 and Z, so could you look at this. What I am asking the NAS  
7 to do is to manage a process that allows you to tell them  
8 what your concerns are rather than for me to try to speak for  
9 you.

10       DR. ALLEN: Garry Brewer?

11       DR. BREWER: Brewer of the Board.

12           There are just a couple things that you have to  
13 really understand about the NAS process. First of all, the  
14 people are volunteers. The second thing is they will be  
15 heavily academics, which is why they don't take instruction.  
16 I mean, your fantasy about specifying what the report will  
17 tell you is just that, a fantasy. I mean, you have to be  
18 realistic about it this. Having managed four or five of  
19 these things over the years, it's all you can do to keep them  
20 in the same room at some point.

21       DR. SUMMERSON: Dr. Brewer, as the daughter of two  
22 academics, I do understand what you are saying to me. What  
23 we're doing is what the advice that the NAS has given us,  
24 that the work scope says what we need and want. Yes, they  
25 can add anything they want to.

1 DR. BREWER: And will.

2 DR. SUMMERSON: And will.

3 DR. BREWER: And delete a whole bunch that you want them  
4 to do. That's just a promise.

5 DR. SUMMERSON: I understand.

6 DR. BREWER: That's not a question. It was a comment.  
7 It's sort of let's be realistic about this process.

8 DR. SUMMERSON: I understand that what we are doing is  
9 setting goals to try to meet. But the fact that it is likely  
10 that we will fall short of the ideal, I do not think is a  
11 good reason not to try.

12 DR. BREWER: Thank you.

13 DR. ALLEN: Other questions or comments? Bill Barnard?

14 DR. BARNARD: Bill Barnard, Board Staff.

15 Jane, how are you going to deal with thermal  
16 loading and site suitability determinations?

17 DR. SUMMERSON: I'm not. I'm going to let Jean Younker  
18 do it.

19 DR. BARNARD: I'll save that question for later, then.

20 MR. ERICKSSON: Leif Ericksson. I'd like to speak in  
21 this position as an ex-NRC staffer.

22 I headed up one of those panels and we actually had  
23 three sub-panels, and it is possible to get some kind of  
24 consensus. I share the concerns about the time schedule  
25 involved, and I also share the concern about the bias aspects

1 that have been coming through. It will be extremely  
2 difficult to get a panel together that doesn't include a lot  
3 of biases that need to be dealt with.

4           My concern about the time, I think the more time  
5 concerns involved with the NRC process is the internal  
6 review. And it's easier to get the panels to get the report  
7 together than it is to get it through the internal review.  
8 But I think that the schedule cannot drive your ambition to  
9 seek a good scientific basis for your program. So I'm very  
10 much in support of what you're doing.

11         DR. SUMMERSON: Thank you. I have been assured by Dr.  
12 Dreyfus in this whole process, that while the schedule is  
13 important, if we come back with a valid well documented and  
14 detailed reason why it's slipping, he will accept that. And  
15 I think it's that the independent technical peer review from  
16 the National Academy, you know, I can't control them. So we  
17 either are looking for an independent peer review or we're  
18 not.

19         DR. ALLEN: Dr. Cantlon?

20         DR. CANTLON: Yes, I'd like to get you to sketch a  
21 little bit the iterative process between the site suitability  
22 determination and the recommendation of the site to the  
23 President. There's a two year process in there. Now, part  
24 of it obviously is related to the EIS incorporation. But is  
25 there anything that you foresee happening in the technical

1 side of the picture, particularly with incorporation of new  
2 data?

3 DR. SUMMERSON: Well, certainly any new data that  
4 continues to be collected will be considered. Licensing  
5 activities will continue to be going on, and we're very much  
6 working closely together on that. So, you know, as I said,  
7 we do recognize the possibility that new data might arise  
8 that requires reopening something, and it could be data that  
9 we find. We're not closing the door on that.

10 DR. ALLEN: Steve Brocoum?

11 DR. BROCOUM: We've had discussions within the project  
12 as to when the data cutoff would be. You know, some people  
13 say three years, some people say two years, some say one  
14 year. I think if any significant data shows up, certainly  
15 that changes a finding we made in the past or changes your  
16 concept of how the site is operating, it will not be ignored.  
17 It can't be ignored. So whether DOE finds that data or some  
18 other party collects that data, it will not be ignored. We  
19 have numerous cases of nuclear power plants when new data  
20 comes up at the last minute, and of course is not ignored.

21 And also we have a formal program that we are  
22 required to implement during site characterization. That's  
23 performance confirmation. So prior to going--presumably  
24 making the site recommendation report, and certainly prior to  
25 submitting the license application, we will have a

1 performance confirmation program in place.

2 DR. ALLEN: You mean if suddenly the water table goes up  
3 600 feet, it's taken into account?

4 DR. BROCOUM: That's correct.

5 DR. ALLEN: Don Langmuir?

6 DR. LANGMUIR: Yeah, Langmuir; Board.

7 This brings up a related question. I would assume  
8 that you'll have things begin, such as thermal loading, which  
9 will not be anywhere near completed when decisions are made  
10 in '98, or even in 2001. Your budget shows a substantial  
11 shrinkage in funding of site suitability evaluations as you  
12 pass '98. Is there flexibility and will there be flexibility  
13 in the program to keep these activities going, longer term  
14 tests that start now or start in two or three years, and will  
15 the money be available to work those programs and keep them  
16 going beyond '98 or beyond 2001 perhaps, if you have to?  
17 Thermal loading being an obvious example.

18 DR. SUMMERSON: The budget money that is identified for  
19 site suitability evaluation relates to funding the  
20 implementation of this process. When that drops off, that  
21 does not directly relate to Susan Jones's site research  
22 dropping off. That's a different budget item. So the site  
23 program--

24 DR. BROCOUM: Let me make a comment on this.

25 DR. SUMMERSON: It's a separate budget.

1 DR. BROCOUM: Yeah, we have, even putting the five year  
2 plan together where we don't have the numbers in this, we do  
3 have it in the internal version, we've allocated all of it,  
4 siting to licensing to NEPA and to management and compliance.  
5 Those are the four categories. We show high budgets for  
6 siting in the early years, which then drops off after '98.  
7 We show lower budgets for licensing, which then rise after  
8 '98. In fact, to some degree, that is an arbitrary  
9 assignment of numbers because a lot of the technical  
10 information serves both needs. So what we're doing is we're  
11 emphasizing suitability early so we're showing that budget  
12 under suitability. The same activities, when they continue  
13 to go on, they'll be shown under licensing in the later  
14 years.

15 DR. CHU: This is Woody Chu.

16 Jane, I'd like to follow up on the question just  
17 before last on technical site suitability. In your viewgraph  
18 on environmental quality, transportation and socioeconomic  
19 just before you went into peer review, the last bullet seems  
20 to be an implied equation, that is, the difference between  
21 technical site suitability and overall suitability is merely  
22 incorporation of the last three factors of environmental,  
23 transportation and socioeconomics.

24 DR. SUMMERSON: That's correct.

25 DR. CHU: Okay. That's kind of satisfyingly crisp.

1 DR. SUMMERSON: We have divided the DOE decisions into  
2 three, and as Steve said earlier, this is anything other than  
3 the site recommendation report, which is statutory in the  
4 Act. It's an arbitrary definition on our part. The other  
5 two, the technical site suitability is defined as higher-  
6 level findings on those guidelines covered in the SCP. The  
7 overall suitability decision is defined as higher-level  
8 findings on the remaining guidelines, i.e. those related to  
9 NEPA.

10 Now, the timing of that overall suitability  
11 decision in relationship to the Secretary's recommendation of  
12 the site to the President could be months, years, days, five  
13 minutes, you know, once that's there, depending on where the  
14 EIS is and the other things that go into that recommendation.  
15 But that's just the arbitrary definitions that we have made  
16 to help make the process more transparent to our oversight  
17 and the public as to what we expect to accomplish.

18 DR. ALLEN: Jane, I think we've had you on the hot seat  
19 long enough. We appreciate your patience.

20 Let's take a break for 20 minutes. We'll reconvene  
21 at 10:20.

22 (Whereupon, a recess was taken.)

23 DR. ALLEN: May we reconvene, please?

24 We're going to start off with a short statement by  
25 Garry Brewer.

1 DR. BREWER: This is Brewer of the Board.

2 Two things that I wanted to clarify for the record.  
3 The first is to publicly apologize for the sharpness of my  
4 comments directed toward Jane Summerson. It was not directed  
5 to her personally, but just what was being said. And for  
6 that, I apologize.

7 The second thing, and I think this is really  
8 important, the Nuclear Waste Technical Review Board is not  
9 against peer review. In fact, we have encouraged peer review  
10 and other kinds of airing and sunshine and ventilation from  
11 day one, and comments about this particular form of peer  
12 review are not be misconstrued at all. Wherever you can get  
13 help, get it.

14 DR. ALLEN: Thank you, Garry. I misread the agenda  
15 slightly this morning. It turns out we have not finished  
16 with the DOE presentation, and Steve Brocoum has about five  
17 or ten more minutes of material to add, and we'll very much  
18 restrict the questioning on that to get on with the rest of  
19 the program.

20 DR. BROCOUM: I want to make a comment here. We're  
21 talking a lot about, you know, in these reviews with the  
22 National Academy and others, the implication is we're trying  
23 to reach a consensus. We're really not trying to reach a  
24 consensus. In my own personal view, I don't think we're  
25 going to necessarily reach a consensus on this program. What

1 we're trying to do is show people we're doing a credible and  
2 a good job.

3           It is our job as DOE managers to take all points of  
4 views and make decisions. Decisions can be that we have  
5 enough information to make a high-level finding, for example,  
6 or we don't have information, we ought to get more data, and  
7 that may impact the schedule. So that's our responsibility.  
8 We're willing to take that on. But we're trying to get all  
9 the help we can.

10           And so at least it came across to me that in some  
11 of the discussion about the National Academy, we're trying to  
12 reach a consensus. We're not trying to reach a consensus,  
13 and I personally gave up--you know, I don't think in a  
14 program of this type, you will reach a consensus. What we're  
15 trying to do is get understanding.

16           Before I go to the expert judgment, I want to make  
17 one other comment because of some comments again that Dr.  
18 Brewer made about the less information. I had a question  
19 this morning about the ESF. I wanted to make that point  
20 again. I think I made it the last time I was in front of the  
21 Board. We are having more information from ESF than was ever  
22 contemplated in the SCP. For the audience that may not have  
23 been here last time, in the SCP, we had two shafts 12 feet in  
24 diameter, 300 feet apart, going down the Topopah Spring, and  
25 no more than two miles of drifting.

1           So I think whatever final configuration we come up  
2 with, we will have more underground information than we ever  
3 envisioned in the SCP base case.

4           Now, I'm going to talk a little bit about expert  
5 judgment, and I'm really talking about expert judgment from  
6 the project perspective, how we think we'll be using expert  
7 judgment.

8           The Board has in their December, in their Tenth  
9 Report, gave us some comments about expert judgment  
10 concerning numerous critical issues that cannot be resolved  
11 by data alone. And, you know, when you're dealing with the  
12 geologic system and predicting for thousands of years, you  
13 obviously require substantial input of expert judgment. And  
14 I think we all know that it's used extensively day by day by  
15 scientists, managers and everyone else without even  
16 necessarily realizing they're doing that.

17           The Board focused on the use of explicit and  
18 formally solicited expert judgment by the DOE in various  
19 studies, particularly in the PA area, and the Board has  
20 expressed concerns what that methodology might be, that we  
21 need to incorporate expertise outside of DOE, and that to  
22 have a successful licensing process, that we need to have  
23 some agreement between the DOE and the NRC on the kind of  
24 process we will use.

25           The NRC, of course, has views on expert judgment

1 also. It has been used extensively in analyzing safety  
2 issues, and examples are the seismic hazard on the east coast  
3 where studies done by Livermore and EPRI were used. The  
4 Atomic Safety and Licensing Board uses experts in the context  
5 of expert testimony during the hearing process.

6           The NRC has a NUREG on peer review, 1297, where  
7 they say because of several unique conditions inherent to the  
8 geologic repository system, expert judgment will need to be  
9 utilized in assessing the adequacy of work. Peer reviews are  
10 a mechanism by which these judgments can be made. They  
11 relate peer reviews to assessing expert judgment.

12           There is also another NUREG from the NRC. The CR  
13 means that it's a contractor report, so it's NUREG/CR-5411,  
14 which means that it does not necessarily reflect the NRC  
15 position, but reflects the contractor's position.

16           But in that, it says expert judgment is likely to  
17 play an important role in identifying and screening events,  
18 scenarios, developing and selecting models that characterize  
19 the geology and hydrology of the repository system, assessing  
20 model parameters, collecting data, and making strategic  
21 decisions about the repository. Most of this refers to the  
22 technical aspects of the program, with the possible exception  
23 of the last phrase.

24           It goes on to say that we could enhance  
25 responsibility and accountability because you have a well

1 documented, systematic process.

2           From our perspective, expert judgment--you know,  
3 for most routine areas, it's implicit you hire experts, you  
4 pay them because of their expertise, and you expect them to  
5 use their expertise in their fields. But you can have  
6 explicit use of expert judgment and can do it in an informal  
7 or a formal structured way, and you may have formal  
8 elicitation.

9           We believe that technical peer review constitutes  
10 one means of obtaining expert judgment, as stated in NUREG,  
11 as the NRC stated in NUREG 1297.

12           In evaluating site suitability, we'll be doing, and  
13 as Jane went through, three basic processes. One is we will  
14 have a technical process where we evaluate uncertainties,  
15 where we look at alternative conceptual models, where we need  
16 to decide whether additional testing will help us understand  
17 and reduce significant uncertainties, the technical area.  
18 That was basically the first box on Jane's diagram.

19           Then we'll have a regulatory area where we do the  
20 regulatory assessment. That's what this is trying to  
21 explain. And finally, the DOE managers have to make, in my  
22 case, have to make a recommendation to the director, and the  
23 director has to make a decision regarding findings. Three  
24 major steps.

25           We see clearly in the first step that formal

1 elicitations of technical experts, both internal and external  
2 to the program, on controversial topics which have large  
3 uncertainties, that prior to development of technical basis  
4 documentation would be useful. And examples are volcanism  
5 where we're planning to do elicitation this year, and I think  
6 we're planning to use outside experts on that panel; seismic  
7 hazard analysis where we're planning to also do a formal  
8 elicitation, and the fact that we needed to describe that  
9 process was one of the comments that the NRC gave us in  
10 refusing to review a technical report--a topical report on  
11 seismic hazard. And finally, in the ground-water travel time  
12 area, some sort of an expert elicitation is being planned  
13 there.

14           So in some areas where there's large uncertainties  
15 or are very controversial such as these, we will use formal  
16 processes of expert elicitation. All the areas where we're  
17 going to produce these technical reports, we will do the peer  
18 review, as Jane described, through the National Academy,  
19 assuming that contract is put in place.

20           For the guideline assessment, that's the regulatory  
21 and policy part, the second, I guess, box on your chart, we  
22 are not planning to use formal structured expert judgment in  
23 those, but we are planning to publish along with the  
24 decision, a rationale. And that was one of the major  
25 comments that came from one of the workshops that was led by

1 Jane.

2           Also I think, listening to Jane's presentation, we  
3 will have lots of interaction with the interested parties and  
4 the public as we develop these, including documents for  
5 comments.

6           We think expert judgment is inherent in complex  
7 analyses, and we think that formal elicitation would be  
8 useful in dealing with technical uncertainties that are  
9 significant in establishing the technical bases that we're  
10 going to use for preparing our assessments.

11           So in the technical aspects of the program, such as  
12 volcanism and seismology and ground-water travel time, we see  
13 a clear use of formal elicitation.

14           So basically, in conclusion, we will focus on  
15 technical issues and provide issues for consideration in  
16 developing our assessments. These results are not decisions.  
17 We view expert judgment evaluation, however they're done, as  
18 decision aiding, and we feel that managers, like Dr. Dreyfus,  
19 need to be free to consider other information that may be  
20 relevant to an appropriate manager reaching that decision.

21           Also, and the reason this here, managers need to be  
22 able to understand and explain the basis, for those that were  
23 around in the '90 to '92 time frame, we had some very complex  
24 ESF alternative studies, the Calico Hills risk/benefits, the  
25 ITE, Integrated Test Evaluation, that became very complex and

1 the only people that can clearly explain in front of the  
2 Board were the decision analysts. So since DOE is  
3 responsible for the program, the kind of process we had has  
4 to be one that DOE can take ownership of and DOE can take  
5 responsibility for.

6           So that's really all I have to say about expert  
7 judgment. We don't have an overall policy as a program.  
8 There were recommendations that came out of the workshop in  
9 1992 which included things like training, having guidelines,  
10 several others, five or six recommendations. There was a  
11 letter from HCNW to the Commission in July of '91 that had  
12 some insight into expert judgment. There was an NEA workshop  
13 in October of '92 that I attended from the Department in  
14 Paris.

15           And we are, now that we're reorganized, expressing  
16 in the program how in the programmatic sense we may, if we  
17 want to come out with any formal guidance, we ought to have  
18 guidance on the issue of expert judgment, but not necessarily  
19 specific procedures. So that's all I can really tell you at  
20 the time. My viewgraphs really reflect how the projects,  
21 i.e. Yucca Mountain project, is intended to use expert  
22 judgment.

23       DR. ALLEN: I'd like to move on just as fast as we can.  
24 Are there any burning questions from the Board? Do you have  
25 a burning question?

1 DR. BREWER: Yeah, I have a burning question. I'm  
2 confused. On the one hand, I think I heard this morning in  
3 the comments from Dan Dreyfus you're going to do as much as  
4 you can do by '98, and then the decision is going to be made.

5 But then in your comments previous, the comments  
6 here, Jane's comments, there is the assurance that if things  
7 don't work out, you'll continue doing the work, putting  
8 information together. If the NAS comes back and says you  
9 need five more studies to get this thing in shape that we can  
10 sign off on, you'll do the five more studies.

11 Now, are we going to decide in '98 or not? That's  
12 the question. I don't get it.

13 DR. BROCOUM: Dan is in the room. I don't see him.  
14 He's not here. Okay. I know he's around somewhere. I'm  
15 giving you my own--I can't speak for the rest of them--my own  
16 personal opinion is that we will, if the information is there  
17 to make a high-level finding and the peer review more or less  
18 says that and we go to the Board, like your Board, and there  
19 aren't major problems, then we'll make that finding. If that  
20 information is not there and we can't make the finding, then  
21 we will not.

22 Dan is now walking down the aisle. Do you want to  
23 repeat the question?

24 But we have a schedule. We're working hard to a  
25 schedule. I think--you know, when you have a very short

1 period of time to do something, you really focus and you  
2 decide what's really important. And so part of the schedule  
3 we had is to get the collective community in our program,  
4 which is very large and very diverse, I guess 2,000 people,  
5 to focus on things that are really important, and that's what  
6 we're trying to do.

7 DR. ALLEN: This is an important enough question that I  
8 think, Dan, you perhaps ought to comment on it, or you might  
9 want to repeat it.

10 DR. DREYFUS: Well, I didn't hear the question as it was  
11 stated. I just got an interpretation.

12 DR. BREWER: I thought you were in the room or I would  
13 not have asked it that way.

14 DR. DREYFUS: I intended to be in the room.

15 DR. BREWER: Basically, it's my confusion in listening  
16 to your crisp presentation, you are doing a lot of very  
17 interesting things in terms of the management of this  
18 project, to get priorities set, to get things focused, to get  
19 it to work, and that's fine. And I infer from that that  
20 there will be a decision in 1998.

21 Then we hear other presentations from Steve twice  
22 and from Jane Summerson that, well, if it doesn't seem to be  
23 working out, if the NAS doesn't approve, we certainly won't  
24 do anything, we will pay attention to the additional studies  
25 that are needed, and so on. So it's confusing. Are we going

1 to make a decision or not?

2 DR. DREYFUS: Well, I guess this requires a  
3 philosophical response, I'm afraid, and it's not going to be  
4 quite as crisp.

5 When I came into the program, it was very clear to  
6 me there was a whole lot going on that had no convergence, no  
7 probable convergence in our time. If it hadn't been clear to  
8 me, it would have been brought forcibly to my attention by a  
9 whole lot of people who are in a position to stop this  
10 program tomorrow.

11 My view of the situation is that if that  
12 perception, if that kind of a picture persists, that a whole  
13 lot of very interesting work is going on, but nobody  
14 understands how it will fit together, and if anybody steps up  
15 and says gee, I think you ought to do "X", we add it to the  
16 agenda. We don't necessarily do it. We don't have enough  
17 money to do it. But sometime between now and decision time,  
18 we'll do anything anybody brings to the table, which I think  
19 is the picture that the world has of this program.

20 Then I am advised and I believe, and I've been in  
21 Washington long enough that I know when to believe people and  
22 when not, that this program will never get to '98 as we know  
23 it. Somebody will decide there's another way to do  
24 something.

25 Now, the question then rises can this program be

1 made to do something, and with the criteria that people  
2 understand what's going on and have some idea of when it's  
3 going to end and what the steps are, that society is willing  
4 to pay for it, and it's a cash flow problem, not so much a  
5 total cost problem, the faster you do it, the cheaper it is.  
6 But there is a cash flow exercised here, and I think, and my  
7 experience in Congress last year is that the profile that we  
8 had before Congress last year pretty much is it. I don't  
9 think we shot low. So I think that that gives us a dimension  
10 of what can be expected over the next few years.

11           And then there is clearly a social tolerance time.  
12 And if you don't think so, you haven't been in the same  
13 rooms I have, and we have court cases, people do not want to  
14 wait forever to find out if this can be done.

15           So now you say, well, what can I do? And clearly,  
16 you'll start with an arbitrary set of deadlines, not entirely  
17 arbitrary, the best judgment of the management of the  
18 program, which is where we started, people who have been with  
19 this program collectively many, many years, and I said what  
20 can you do. Let's go and look at what has to be done, and  
21 that gets you back to the documents, what has to be done.  
22 And what can be done, what has to be done, and can we in fact  
23 give a credible document to the Nuclear Regulatory  
24 Commission, which is the end point for this game, and can we  
25 do it in how much time.

1           I did not give them a schedule. I gave them an  
2 idea about how much resources I thought we're likely to be  
3 able to get. At that time, that was a guess. At this point,  
4 I have a fair amount of confidence that that's about it,  
5 because I've had a Congressional budget cycle. I told you a  
6 year ago I had to do that budget cycle now, not later after  
7 we did reorganizations or whatever, and that's why, because I  
8 needed that information. I've got it.

9           Now, nobody in their right mind would suggest that  
10 if the Nuclear Regulatory Commission tomorrow were to say  
11 what we see in these documents--and the documents are not yet  
12 done, you've got drafts in front of you of some of them--what  
13 we see in these documents will not get you a docketable  
14 application, that we'd say well, fine, we're going to file it  
15 anyway. That would be ridiculous.

16           On the other hand, I am not willing at this point  
17 to suggest that, gee, it sounds like it's going to be hard to  
18 do, so let's change it. The way you manage it is you set  
19 some rational guidelines, some rational schedules, and you  
20 manage to the schedules, you change the schedules when you  
21 know why you changed them. And at this point, I don't know a  
22 reason to change our schedule.

23           And what Jane said today is pretty much what I have  
24 told everyone in the program. That if you come to me and you  
25 tell me this can't be done because we found "X" and now we

1 have got to do stuff that we didn't have in this plan, that I  
2 will go and tell the Congress and the world and the Secretary  
3 that it takes more time and it takes more money, and they'll  
4 do what they need to do. But I want to be able to tell them  
5 it takes more time and it takes more money because this  
6 happened, not just we threw the work over into the next  
7 fiscal year because we didn't quite get it done, or we didn't  
8 quite have enough money to do it, or whatever.

9           So that's the difference. We're going to manage to  
10 a schedule, and we're here seeking input. And if anybody in  
11 a position to give us input tells us it isn't good enough,  
12 we'll see what's good enough. We'll price it out and we'll  
13 go back and report that that's what's good enough.

14           So I have no problem saying what we thought it was  
15 good enough has proven not to work, but I want it proven not  
16 to work, not just another suggestion that perhaps in another  
17 ten years and another few billion, we could do a better job.

18       DR. ALLEN: Thank you. I think that does clarify to  
19 some degree the point. May we move on?

20       DR. BROCOUM: I just want to make one comment. A lot of  
21 people say they weren't able to get a copy of that five year  
22 plan, that they ran out. So we're trying to print another  
23 hundred and we're trying to have them here after lunch.

24       DR. ALLEN: Thank you, Steve.

25           We should now move on to Malcolm Knapp of the NRC,

1 that is, the Nuclear Regulatory Commission.

2 DR. KNAPP: I'm Mal Knapp. I'm with the Nuclear  
3 Regulatory Commission, where I'm in charge of the Division of  
4 Waste Management. In the next 15 or 20 minutes, I hope to  
5 give you some of our views on DOE site suitability plans. I  
6 hope to address the concerns that the Board has raised. I've  
7 changed the order a little bit.

8 I want to talk a little about the interface we  
9 anticipate having with DOE, some of our concerns as a  
10 regulator, and a couple of comments we have on the  
11 implementation of 950, perhaps as friends of the court.

12 I'd like to note that we are still learning about  
13 what's going on. It seems as though I'll come to meetings  
14 like the one today and DOE will make a couple of  
15 presentations and I'll make one, and I know about 10 per cent  
16 more after the DOE presentations than I did before I wrote my  
17 talk. So the program is changing. We are still learning.  
18 So things that I have to say are preliminary, and if I come  
19 before you again in a month or two, I would expect I'll say  
20 something a bit different.

21 I also note that much of what I have to say today I  
22 think has already been ventilated at least in part by  
23 questions by Board members and others. I think you'll find  
24 we share a number of the concerns that you have.

25 Before I get to the concerns, though, I would like

1 to make sort of a general remark on now the program approach  
2 and site suitability work, and that is in general, I'm  
3 encouraged by it. I've been back involved in the high level  
4 program for about six months, and a couple of the concerns  
5 that I had early on in my first look were that DOE did not  
6 appear to be well focused, nor did they appear to be well  
7 coordinated. And I see the benefit of this program in part  
8 as bringing focus, coordination and integration to this  
9 program, and I applaud that. And I want to make sure before  
10 I begin to pick away at some of the smaller pieces, that you  
11 understand that overall, I am pleased by the way things are  
12 headed. I hope that DOE doesn't get caught with the devil  
13 and the details. But the initial scheme seems to me to be a  
14 good direction to go.

15           Speaking about the DOE/NRC interface, one of the  
16 first points to be made is that we regard the implementation  
17 of 960 as a DOE responsibility. They are going to be making  
18 their decisions on site suitability. We become active, of  
19 course, in the licensing process. And for that reason, our  
20 focus on their site suitability work will be as they develop  
21 their prelicensing information in support of their  
22 application. Therefore, we will be looking at it with  
23 respect to 10 CFR 60.

24           With that in mind, and thinking about the  
25 interface, I have some concerns about how they're going to

1 issue their pre-licensing products, and some of those were  
2 resolved a bit this morning by some of Dr. Summerson's  
3 remarks. But again, we're bringing this into focus, and one  
4 of the strong actions NRC will be taking over the next months  
5 is that at every step in this process, it's my intent to  
6 interact a lot with DOE. We're going to be reviewing the  
7 five year plan carefully, we will be reviewing their  
8 technical implementation plan, now due I believe in November,  
9 carefully and we're going to be commenting on areas where we  
10 believe we have concerns or where we think they may be moving  
11 in a direction that will not lead to a sound license  
12 application.

13           To give a little background for a couple of  
14 comments I'm going to make later, this is the I hope current  
15 version of the site suitability decision, waterfall diagram.  
16 We put this one together because it's a little simpler than  
17 the DOE version.

18           The only point really to be made here is that among  
19 the higher-level findings, one which will be coming in now in  
20 less than a year, I believe it's coming at the end of fiscal  
21 '95, not calendar '95, will be their high-level finding on  
22 surface processes. We see the high-level findings as the  
23 focal point of the DOE site suitability program, and so our  
24 interaction and our comments are largely focused on those.

25           The next viewgraph you've already seen. The

1 interaction that Dr. Brocoum mentioned, the recognition that  
2 960 and 60 are not inconsistent. We have no difficulty with  
3 that. We see the data collection analysis steps coming  
4 together with these steps, synthesis, technical report,  
5 external review, and then coming into the suitability  
6 analysis and the regulatory analysis.

7           One of the things I would note, as I think Steve  
8 Frishman would remind me if I did not, is that the agreements  
9 with the NRC here will be resolution, not closure. The sorts  
10 of agreements we anticipate we would reach would be DOE has  
11 taken as much data and done as many analyses as we think are  
12 necessary at this point. We would not expect that we would  
13 reach closure on issues. That must wait of course until the  
14 licensing process.

15           Now, here I'm still interpreting a bit what DOE is  
16 doing. And please correct me if I misinterpret. The  
17 viewgraph that Dr. Summerson spoke to at some length I think  
18 is a blow-up of these two bullets, and that is their  
19 suitability evaluation process. And I will not take up your  
20 time with reiterating what she has said about development of  
21 the basis, the review, involvement with the National Academy,  
22 public comments and what have you, although I would note one  
23 thing. This is the viewgraph I received from them on--I  
24 think took away on a presentation on the 28th of September.  
25 You notice the word observation. I believe your current

1 viewgraph says participation, and that's commendable.

2 DR. SUMMERSON: And instead of address public concerns,  
3 it says, I believe, address external technical--I'm sorry,  
4 there's another change there. Instead of addressing public  
5 concerns on that technical basis, it's addressing the  
6 technical issues raised by the external--these are just words  
7 to try to clarify understanding.

8 DR. KNAPP: Right. But that leads to a couple of  
9 points. As I said, not only are we still learning about the  
10 program, the program and the plans are changing as we learn,  
11 so that is one of the reasons our comments are preliminary.

12 But another thing that I've noted, which I commend,  
13 is I think here, DOE was responsive to a strong desire for  
14 public participation as opposed to observation. And watching  
15 this process develop as we go out to these meetings, I am  
16 getting at least a feeling that DOE is attempting to listen  
17 and attempting to be responsive. I commend that and  
18 encourage it to continue.

19 But going back--now that I've said something good,  
20 I have to turn this around. I'm concerned about this process  
21 because I see much of this process as being isolated in these  
22 areas on this viewgraph, which leads me to the concern that  
23 if it works out this way, by the time that DOE brings us a  
24 regulatory analysis, they will have gone through one, perhaps  
25 two public comment periods, a peer review by the National

1 Academy of Science, or however that finally works out, and  
2 bluntly put, I'm concerned we might be faced with a fait  
3 accompli.

4           For that reason, it is my intent that we will be  
5 heavily involved in the public participation here, and in  
6 public comment here. Now, in the best of all possible  
7 worlds, it would be very nice if DOE could put a package  
8 together and then we could review it as regulators. I don't  
9 think we can afford to wait. I don't think it would really  
10 be responsible for us to wait.

11           If we think that DOE is headed in a direction,  
12 regardless of its merits for site suitability, which does not  
13 lead in our view to the completion of a successful license  
14 application, I think we need to tell DOE as early as  
15 possible. I think we'd have good reason to be faulted if we  
16 are not.

17           So exactly how we will interact still remains I  
18 think to be worked on as we learn more about DOE's process,  
19 and as we review it. But one message I'd like you to have is  
20 that it's my intent to review these things early and  
21 intensely, and if my understanding I think that the surface  
22 processes report will be out in February is correct, then  
23 we're going to be getting into that in February. We will not  
24 be waiting until it finally gets into the last steps.

25           I mention a couple of concerns that I have as a

1 regulator, and these concerns are again somewhat modified by  
2 what I've heard this morning. As I think most of you are  
3 aware, DOE is focusing on qualifying and disqualifying  
4 conditions and may or may not be setting favorable and  
5 potentially adverse conditions aside.

6           Again, with respect to DOE's responsiveness, I was  
7 pleased to hear that you will reconsider using favorable and  
8 potentially adverse conditions.

9           The reason I'm concerned about that is that I see  
10 these as having a significant role in the license  
11 application. These things appear in 10 CFR 60 and will need  
12 to be considered, and I think that it is very much in DOE's  
13 interest to ensure that in developing the site suitability  
14 decision, they do not neglect or back burner the favorable  
15 and potentially adverse conditions to the point that they  
16 will have been left out of the picture and not fully  
17 considered when they bring in the license application later  
18 on.

19           I have no disagreement with the focus on qualifying  
20 and disqualifying. My only concern is that the others not be  
21 neglected to the point where you look around one day and find  
22 out you do not have the technical basis that you hoped you  
23 have to suppose these.

24           And similarly, recognizing at least in my view what  
25 DOE is doing here is a management decision to try to make in

1 1998, I think Dr. Dreyfus has said this morning does it make  
2 sense to continue. Well, in my experience, the quality and  
3 completeness of the information that you need to make a  
4 management decision are not necessarily anywhere near as  
5 severe as the quality that you need of information to support  
6 your case in an adjudicatory process.

7           So a concern I have here is that DOE is careful,  
8 and I think this is something the Board already mentioned, in  
9 fact be sufficiently complete, have sufficient quality  
10 assurance work done with it, that if they wish to use this  
11 data later on, or these analyses to support the license  
12 application, they will not find that, in fact, they have to  
13 go back and repeat them because the quality of work simply  
14 cannot be demonstrated to be good enough to support an  
15 adjudicatory hearing.

16           A few comments on the implementation of 960 itself.  
17 Again, I'll be interested in how these are flushed out by  
18 what DOE does in the development of the program.

19           We're a bit concerned that the higher level  
20 findings may have difficulty in actually meeting the  
21 expectations of the public or the Board or others. With the  
22 amount of data currently available, it's not obvious to me  
23 that the higher level finding, as described this morning,  
24 this is good, for example, the qualifying condition is  
25 present, we don't foresee anything coming at us in the future

1 that is going to cause it to be absent, it's not obvious to  
2 me, based on what I now know, that they can reach a higher  
3 level finding on some of these qualifying conditions with the  
4 information currently at hand. And in some cases, for  
5 example, surface processes, I believe they will be dealing  
6 with the information currently at hand simply to be able to  
7 get it to a point where they can finish this by the end of  
8 fiscal '95.

9           That leads me to the next concern, that tight  
10 schedules may limit the data and the analyses that they can  
11 perform. This was--a comment again, to change this a little  
12 bit, results from a conversation that I had with Lake Barrett  
13 about two weeks ago. He called me and he had just finished a  
14 meeting, I believe, with some DOE people out here to exhort  
15 them to make progress on the tunnel boring machine, and he  
16 wanted to make sure that the NRC got the message that he had  
17 in mind when he gave them that exhortation.

18           He said he gave them three priorities. The first  
19 priority was safety. The second priority was procedure, to  
20 include quality assurance. The third priority was schedule.  
21 He wanted to use a schedule to keep things moving, to force  
22 action, but his first priority was safety and his second was  
23 quality assurance to do the job right, to do it properly.

24           Again, I found that encouraging and I would encourage  
25 DOE to continue in that process so that the tight schedules

1 do not wind up becoming limiting. Again, I think I'm saying  
2 very little that was not already said in other ways.

3 I'm concerned that some of the bounding decisions  
4 that DOE wishes to reach may be very difficult to make. And  
5 that relates in part to a concern that some of the higher  
6 level findings may not be separable, to go back to the  
7 earlier schedule that finds findings in particular areas  
8 changing at different times with the waterfall diagram. And  
9 I'll return to it for just a moment.

10 It's not clear that these things in fact can be  
11 made separately. I'm not sure that it's possible to make  
12 some of these without consideration of other aspects of the  
13 repository, perhaps most of all the total system performance  
14 assessment. Now, I recognize there will be performance  
15 assessments performed about annually as DOE continues the  
16 suitability, but whether they will be extensive enough to  
17 support conclusions reached in high level findings is  
18 something that I'm concerned about, and that's something that  
19 we'll be looking at carefully as we look at the DOE products  
20 that are coming in.

21 To talk about one of those in just a little bit to  
22 illustrate my concern, let's again return to surface  
23 processes coming in in a year. I believe that DOE will be  
24 reaching conclusions, if my understanding of the draft of the  
25 five year plan is correct, on about five conditions

1 associated with three guidelines, qualifying, disqualifying  
2 and erosion, qualifying on surface characteristics,  
3 qualifying and disqualifying on hydrology, and I'd like now  
4 to expand on that a little bit and talk a little more about  
5 erosion in particular.

6           And here, I've taken the liberty of paraphrasing  
7 some words in 960 and combining them. The gist of the  
8 qualifying condition; erosional processes at the surface are  
9 unlikely to cause radionuclide releases greater than those  
10 allowed under EPA standards and NRC regulations. Again, this  
11 is a paraphrase, but if you look at the qualifying condition,  
12 you look at the reference to I think 960.4-1, that's where it  
13 comes in.

14           Well, this is going to be an interesting conclusion  
15 for DOE to reach. If they reach this in the fall of fiscal  
16 '95, that will be three months before, optimistically, EPA  
17 has completed its final version of the high level standards,  
18 and a year and three months before NRC has made any necessary  
19 changes it needs to make to 10 CFR 60. Now, that doesn't  
20 mean you can't do it.

21           But what I think it means to me is you're going to  
22 have to take your worst case scenario in terms of how  
23 rigorous EPA will be and how rigorous NRC will be, and then  
24 reach your higher level finding and the qualifying condition  
25 with enough conservatism and bounding assumptions so that no

1 matter how conservative we are reasonably likely to be, you  
2 in fact can find that qualifying condition to be present and  
3 unlikely that it will change in the future.

4           That may turn out to be a tall order. Perhaps not  
5 in this condition. I think surface processes are an  
6 appropriate one to start with. I think in the concept of  
7 separability, they're probably as likely as any of the HLFs  
8 to be separable. But it does speak to the fact that your  
9 bounding assumptions and your conservative assumptions may  
10 have to be pretty conservative, and I'm concerned that DOE is  
11 going to reach a closed set. That is, by the time you make a  
12 sufficiently conservative assumption, that with the slack you  
13 have to cut everywhere else in the program for that  
14 assumption to work, you may find that you can't meet that  
15 assumption at the site. I think that's going to require a  
16 lot of very careful attention and, again, another area where  
17 we plan to be watching closely.

18           On the other hand, the disqualifying condition  
19 looks like something that's pretty straightforward, frankly.  
20 I mean, that's separable. It's not like other things.  
21 Either you can or cannot get down at least 200 meters below  
22 the surface, and that's one where we would be more optimistic  
23 you could reach a finding on that condition.

24           That really concludes the views we have at this  
25 point. I'd like to summarize with a couple of comments.

1 We're still changing these things, our comments, as we look  
2 at the program. I think the program is frankly--I think to  
3 try to accomplish what DOE has set out to do in the time  
4 table that they have is going to be challenging to say the  
5 least, and I wish them every success.

6           We will work closely with them, and when we find  
7 inconsistencies or holes on a detailed basis, we're certainly  
8 going to share them with DOE and we're going to share them  
9 with you.

10           That concludes my remarks. I'd be happy to answer  
11 questions, if I can.

12       DR. ALLEN: Thank you. Questions from the Board? Don  
13 Langmuir.

14       DR. LANGMUIR: I'd like to get into some of the details,  
15 if I could. One of the major NRC regs applies to ground-  
16 water travel time, and the need for that to satisfy the 1000  
17 year or greater arrival.

18           My understanding is NRC's definition of a disturbed  
19 zone is key or integral to that definition, and that we're  
20 looking at a definition of a disturbed zone which was written  
21 ten years or more ago. If that definition as I understand it  
22 is still applied, and it seems to be still applied by NRC, it  
23 makes the whole repository, the disturbed zone, under a high  
24 loading scenario, and may make the travel time zero in the  
25 worst case just because of the definition that NRC is

1 requiring DOE to use. I wonder how you feel about that, and  
2 if NRC is reconsidering defining the disturbed zone as a  
3 starting point for travel time.

4 DR. KNAPP: First, you're right; it was written, in fact  
5 I wrote it or had a major hand in it 15 years ago. Somebody  
6 once said one of the things that you should do in the federal  
7 government is to stay around long enough to realize the  
8 consequences of your actions.

9 I'm not going to take up an awful lot of time. If  
10 the Board wants, I can be eloquent on why we put it in there  
11 and what we had intended. But the fact is we were more naive  
12 about geologic disposal. We were looking in those days at a  
13 different set of sites, and the concept of--and we had  
14 different technical information, which I'm not sure over the  
15 intervening 10 or 15 years has been fully supported.

16 To answer your question briefly, I am taking a look  
17 at exactly how useful the disturbed concept is or whether or  
18 not it's properly applied. Now, I can't tell you what the  
19 Commission might decide, and I have not had my staff develop  
20 enough information that I'm ready to say anything one way or  
21 another.

22 I can tell you that your concern is valid, it's one  
23 that I share, and I think we need to ask are we in fact  
24 throwing out the baby with the bath water. Have we in fact  
25 created a disturbed zone which makes it impossible to have

1 any ground water distance at all. I think it needs to be  
2 asked. That was not our intent when we put it together in  
3 the regulation, obviously, and if it turns out we don't need  
4 that intent because of our increased understanding of  
5 technology, we'll revisit it. That's all I can tell you now.

6 DR. LANGMUIR: It leaves us with the peculiar problem  
7 that the disturbed zone, which perhaps is the best thing  
8 we've got at the mountain to isolate the waste, isn't  
9 considered as part of a beneficial aspect of the system. It  
10 isn't considered for its usefulness in isolating the waste if  
11 we start the timing from beyond it.

12 DR. KNAPP: Well, as a matter of fact, that was exactly  
13 the argument we thought would be made, which is why we wanted  
14 to start the timing beyond it. We were very skeptical of the  
15 technical merit of that argument. You know, it may have  
16 tremendous merit.

17 The problem that we had at the time was that we  
18 foresaw an argument should we start the ground water travel  
19 time at the edge of the repository, and should we be in a  
20 repository with what amounted to aquacludes above and below  
21 and beside it, which was certainly contemplated in those  
22 days. And I'm talking about a saturated repository. That  
23 the licensee would come in and say hey, the way this works,  
24 we can meet the ground water travel time in the first ten  
25 feet, and the rest of the site could be swiss cheese.

1           Well, that's fine except as we all know in this  
2 room, is this thing goes through the thermal cycle, exactly  
3 what would happen to an aquaclude is certainly beyond my  
4 ability personally to perceive, and so we wanted to forestall  
5 that argument. We wanted a measure of the quality of the  
6 site in which we could have some confidence that as time  
7 passed, would not have run the potential of being  
8 dramatically changed.

9           Now, I'm not saying it would be changed at that  
10 end; it's in our ability to predict it. So what we had in  
11 mind was to try to force the issue for ground water travel  
12 time to be something that could be measured. That's why we  
13 use pre-emplacment ground water travel time, something that  
14 we could look at with some confidence that as the site  
15 progressed through the millennia, we'd have something that we  
16 would have some confidence, based on measurement of existing  
17 information, would be unlikely to change.

18           As I said, that all was predicated on information  
19 we had at that time, based on those sites and those analyses  
20 that suggested that perhaps of the controlled area, 10 per  
21 cent might constitute the disturbed zone. So we're going to  
22 have to go back and take another look at that. As I say,  
23 that's a legitimate challenge to that particular part of the  
24 regulation.

25         DR. ALLEN: Any other questions from the Board? I think

1 we probably ought to move on. Thank you.

2           Our next presentation is by Steve Frishman of the  
3 Nevada Nuclear Project Office.

4           MR. FRISHMAN: As is often the case, I don't have any  
5 viewgraphs to bore you with.

6           Just as Mal has been doing, I've been trying to  
7 interpret this whole site suitability process from the very  
8 first time I've heard anything about it, and I don't know  
9 whether 10 per cent new knowledge every time is the right  
10 number, but there's certainly new and sometimes startling  
11 knowledge every time I hear anything about this developing  
12 site suitability process.

13           I think what I want to do today is put my comments  
14 sort of in context of some things that we heard today and  
15 things that I tried to listen to very carefully that are sort  
16 of new statements within the context of the description and  
17 discussion of this process. I think your questions earlier  
18 brought out some of the things that I was interested to hear.

19           I'll just touch on some various aspects of what I'm  
20 interpreting out of the proposed process, and some of the  
21 real concerns that I've got. Many of the regulatory concerns  
22 I think Mal did a good job of explaining, and we agree with a  
23 large number of the concerns the way they're stated.

24           Let's start out with the idea that as now I've  
25 heard stated first a couple weeks ago and now it's getting

1 more and more firm in the rhetoric, and that's the technical  
2 site suitability decision is a business decision. It's a  
3 decision, as I heard it described a few days ago, a decision  
4 whether to continue to investment towards the license  
5 application. And that in itself I think is an interesting  
6 approach, and when it's coupled with the second statement  
7 that was made a couple weeks ago, beyond the one about  
8 technical site suitability being a business decision, and  
9 that's that the decision to submit a license application is  
10 the safety decision.

11           Now, that brings me to kind of question why that  
12 difference is set out there, because in reality, being a  
13 technical site suitability determination in 1998 or whenever  
14 it is done prior to a suitability determination and a  
15 Secretary's recommendation, is in fact the support ultimately  
16 for the Secretary's recommendation. And the Secretary's  
17 recommendation certainly is not a business decision. The  
18 Secretary's recommendation must, under the Nuclear Waste  
19 Policy Act, be a safety decision.

20           So I'm a little bit confused about how the  
21 rationale is developing, and I'm beginning to see that it  
22 seems almost to be developing because it has to be used to  
23 bridge various portions of the puzzle that maybe we're not  
24 seeing very well. But that's one that I think needs to be  
25 held up front because technical site suitability at the,

1 well, nominally 1998, two years before a--or three years  
2 before a safety decision is made, what is going to be done  
3 within that period of time that will improve the quality of  
4 the safety decision.

5           Technical site suitability was stated to be done,  
6 unless something new turns up, and three years later after  
7 the rest of the guidelines have been applied--and I'll talk  
8 about that a little bit later--then you all of a sudden come  
9 to the ability to make a safety decision. What's happening  
10 in that period of time that takes you from a business  
11 decision to a quality safety decision? I don't get it. So  
12 that's something I think that needs to be considered in the  
13 whole scheme of this process.

14           Now, I heard another bridge statement today, and  
15 I've been trying to figure out what it means and I think I'm  
16 beginning to get it. And that's that Steve Brocoum said that  
17 960 is more focused on the site, while 10 CFR Part 60 is more  
18 focused on performance.

19           Well, I want to show you sort of a stream of logic  
20 that shows that this really can't be, but I think I've  
21 finally figured out why this bridge had to be built, and I  
22 had not heard it before. I think it has to be built to  
23 defend the concept of separability of guideline decisions.  
24 It seems to be that's about the only way you can do it if you  
25 make the interpretation that that's the difference between

1 the two.

2           But let me show you how it doesn't work. For a  
3 technical site suitability determination, what you've got to  
4 do is make a determination that the site is not disqualified  
5 or you have to make a determination that the site meets the  
6 qualifying condition. You have to make both of those  
7 decisions.

8           Now, in order to demonstrate that the site meets  
9 the qualifying condition in all of the guidelines which are  
10 applied in technical site suitability, the qualifying  
11 condition is a performance condition. It's one that  
12 essentially says, just as Mal showed, says that under this  
13 guideline, the site will meet the release standards of both  
14 EPA and NRC regulation, and that's about it. That's about  
15 what the qualifying condition says. And that is a  
16 performance determination.

17           So how can you be in a situation where you're  
18 trying to separate the pieces out, have separability among  
19 the guidelines, and at the same time, try to insist that it's  
20 a site, really just a site factor, but you're really making a  
21 performance determination that requires understanding the  
22 full gamut of the site.

23           And it also requires another thing that was pointed  
24 out in the NRC's recent letter about the PPA; it also  
25 requires that you factor in the waste package in order to

1 make that performance determination, and nowhere in technical  
2 site suitability are we dealing with a waste package. We  
3 don't know what that waste package is, and according to DOE  
4 schedules, we won't know what that waste package is.

5           So we're to the point where I think in 1998, the  
6 technical site suitability decision is going to, almost of  
7 necessity, if it's going to be defensible at all, is going to  
8 have to say we don't think it's disqualified, but we can't  
9 demonstrate that it's qualified because we don't have enough  
10 to do a credible performance assessment because the program  
11 has not even been scheduled to give us enough to do that.

12           Now, I guess what I'm saying is you can't have it  
13 both ways. You can't say that the guidelines or that 960 is  
14 more for the site, when in fact you're trying to make it work  
15 for performance when you don't have the information and  
16 knowledge capability to make it work for performance.

17           Now, I guess you're well aware that we have had a  
18 gripe all along about the guidelines, and we got dismissed  
19 from the court in our lawsuit over the guidelines and the  
20 fact that we believed they were inadequate under the Act, and  
21 we got dismissed for what we believe, and I think even the  
22 surliest of lawyers would believe, was a really foolish  
23 decision. But anyway, I guess we're all going to pay the  
24 price for that decision anyway.

25           Now, in general, we think that the whole concept

1 the Department is using about the guidelines, or trying to  
2 use about the guidelines being a performance measure, even  
3 though just today we're thinking what we're hearing to defend  
4 something else, sort of illogically they're saying that it's  
5 less a performance measure.

6           Now, we still go back to 112(a) in the Act to try  
7 to find out what the guidelines ought to be to make a site  
8 suitability determination, and it's pretty hard to find that  
9 the act contemplated that it lead to a massive performance  
10 determination. The Act seems pretty clear that there are  
11 site characteristics that you should be concerned about, and  
12 you should be concerned about them way up front before you  
13 ever worry about overall system performance.

14           And just to remind you of the words and what I  
15 think is essentially their clarity, let me just read you  
16 about three lines of it without getting into all of the ten  
17 mile long sentence that's in 112(a). "Such guidelines shall  
18 specify detailed geologic considerations that shall be  
19 primary criteria for the selection of sites in various  
20 geologic media. Such guidelines shall specify factors that  
21 qualify or disqualify any site from development as a  
22 repository, including factors pertaining to the location of  
23 valuable natural resources, hydrology, geophysics, seismic  
24 activity," et cetera, et cetera.

25           I don't see a lot of performance in there. I see

1 the Congress saying be very, very careful about selecting a  
2 site in terms of collecting and understanding the information  
3 that is there and you can measure one way or another in order  
4 to determine whether you can understand that site, and then  
5 whether those factors themselves are acceptable as you go  
6 forward towards performance.

7           So I guess the approach that I'm seeing with the  
8 site suitability determination and the technical site  
9 suitability determination, I think first of all is really not  
10 linked to the thinking that was in 112(a) in the Act, and I  
11 think now having heard this latest concept that came up  
12 today, I think it's illogical and I think it's trying to have  
13 it both ways, and you can't have it both ways.

14           We have maintained all along that the site should  
15 be analyzed first based on the geologic and hydrologic work  
16 that you can do there to try to understand it, try to  
17 understand it in terms of maybe it needs to be the best  
18 understood piece of geology on earth, but try to understand  
19 it in the context that geologists and hydrologists try to  
20 understand sites, not in the context that nuclear engineers  
21 try to understand the repository site.

22           So I think we need to go back to some real basic  
23 thinking about this whole process, and especially since  
24 you're going to be in a situation where you just don't have  
25 the data to do anything other than some very high flying

1 performance assessments that aren't going to convince me, and  
2 I'm kind of doubtful that they're going to convince very many  
3 people.

4           Now, let me talk in the context of the technical  
5 basis report. I'm still trying to figure out what that  
6 technical basis report is or will be. I imagine some work is  
7 being done on trying to outline it, but it seems to me that  
8 if it's going to be used the way the peer review process and  
9 the box process is laid out, then the technical basis report  
10 really has got to be everything you think you know in a  
11 particular area of geology or hydrology.

12           And if you go back and look at DOE's schedules for  
13 the PPA, we look at 1997, we have a whole list of things that  
14 are called site investigations, 3-D geologic description,  
15 climate, post-closure tectonics, UZ, SZ geochemistry, UZ  
16 hydrologic description, saturated zone hydrologic  
17 description. You look at those, all of those are going to  
18 be, at best, bounded in 1997.

19           Now, if the technical basis report is tell me  
20 everything you know in each one of these areas, then how is a  
21 peer review group going to deal with bounded information in  
22 the sense of everything you think you know and everything you  
23 think you need to know at this point. How are they going to  
24 deal with bounded information? The UZ hydrologic model could  
25 be this, could be that, and now the only criteria you could

1 use for saying, well, that bounds it and it doesn't matter  
2 which it is, is if you know what you want to apply that to,  
3 if you know what you want to apply that technical basis to.

4           Now, if you're doing that, then what you're doing  
5 is you're sliding over into the next box, that next box being  
6 the one about guideline compliance assessment. Now, I don't  
7 think we want the NAS doing a technical peer review in the  
8 context of forecasting into that next box of guideline  
9 compliance assessment, because that's not what their  
10 expertise is.

11           What the hope is is that you will get an erudite  
12 technical review of everything you think you know about  
13 unsaturated zone hydrology, regardless of what it's going to  
14 be used for. Well, that doesn't work. It can't work,  
15 because you can't get the NAS peer reviewers, I think, to do  
16 an adequate review if they don't know what the material  
17 they're reviewing is going to be used as a basis for. And it  
18 makes a very difficult situation that they get into, and I  
19 heard one other thing from Jane today that makes it even more  
20 difficult, and that's that in their discussions over the  
21 contract, the NAS doesn't want to be put in a position where  
22 they have to make a judgment over whether the right tests  
23 were done.

24           So what are we going to get out of anybody's,  
25 including an NAS peer review of a technical basis report,

1 unless you blur that line between technical basis and  
2 guideline compliance, and I really believe we don't want the  
3 National Academy in guideline compliance because that is a  
4 management decision that DOE is solely responsible for, and I  
5 don't care how many scientists you stack on it, the  
6 management decision isn't going to be different from what the  
7 managers want it to be anyway.

8           There's no way in this situation that you can  
9 separate out a purely technical review and do it independent  
10 of what that material is going to be used for. So I think  
11 this whole process needs to be re-thought, or at least cast  
12 honestly. Say that you can't do it by these very firm lines  
13 between the types of analyses and reviews that are done, and  
14 figure out some process that maybe we all won't like it, but  
15 at least you're telling honestly what you're doing.

16           And you can't, I think, go through this thing  
17 without a firm understanding that ultimately what DOE  
18 management wants is to have some way to shore up a technical  
19 site suitability determination, and you can't fool the people  
20 when you say we have an independent scientific review of the  
21 information, when the reviewers didn't know why they were  
22 reviewing that information.

23           And, you know, unsaturated zone hydrology I think  
24 is a great example to look at. You get a peer review in  
25 there and just segregate it completely from the whole concept

1 of what the regulations and the guidelines say, and hand as  
2 much information as the Department wants to give to a peer  
3 review group and say okay, here's everything we know about  
4 unsaturated zone hydrology at that site, but remember it's  
5 just bounded still. Now, is this okay?

6           Do you really think a group of professionals, self-  
7 respecting scientists are going to say yeah, that's great,  
8 that's all you need to know? They can't tell you that  
9 because they're scientists and they know that they do not  
10 have truths; they have various possible models and versions  
11 of the truth. And what they really want is the truth, and  
12 you can't get there from here with this process.

13           So I think that's a problem that is inherent in  
14 this process and I think the whole process ought to be re-  
15 thought and have sort of honesty brought to the forefront and  
16 say what really is going on and say what is impossible to do.

17           One final point that I wanted to make is that it  
18 appears from the way both Jane and Steve were speaking that  
19 the peer review of the technical information is intended to  
20 be the place where those of us who are doing technical  
21 oversight are going to need to plug in everything we think we  
22 know, and that's going to be tough because we hadn't planned  
23 on it, and also because it puts us in a position where  
24 ultimately that NAS panel is going to be, if they review our  
25 work at all, they're going to be peer reviewing our oversight

1 work as well as everything DOE thinks it knows, and there are  
2 going to be some choices made there that are probably going  
3 to be irreversible for us as oversight, even if we disagree  
4 with those choices.

5           And I guess all I can remind you is that if we get  
6 put into that position, then it makes our effort, if the  
7 process continues to go forward, it makes our effort with a  
8 notice of disapproval an extremely important effort, because  
9 we're going to be out there trying to tell Congress then that  
10 our oversight work was rejected, not even by DOE, but  
11 rejected by a peer review panel, and our concerns never did  
12 get to the point of being able to deal with site suitability  
13 because we had sort of an internal process, and now we're  
14 going to try all of these issues and we're going to show you,  
15 the Congress, how unsafe this site is, regardless of all of  
16 the people who in separate little boxes said things that DOE  
17 management added up to say it's a safe site.

18           So it's going to change the whole nature of how we  
19 have to do our business if the NAS peer review becomes the  
20 point in the process where DOE essentially discharges  
21 whatever technical work we as oversight people may have been  
22 doing.

23           That's enough for now, I think.

24       DR. ALLEN: Thank you, Steve. You're right on schedule.

25           We have certain logistical restrictions in the

1 hotel here, so we've got to quit about on time.

2           Are there any important questions here from the  
3 Board itself?

4           Okay, thank you. What we're going to do is delay,  
5 because of these logistical restrictions, delay the talk by  
6 Steven Kraft until after lunch. So we'll adjourn now at the  
7 scheduled time, 11:30, and reconvene again at 12:45 as  
8 scheduled. Thank you.

9           (Whereupon, the luncheon recess was taken.)

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

1

2

3

4

AFTERNOON SESSION

5 DR. ALLEN: Okay, can we go ahead, please?

6 The first speaker on the afternoon's program is  
7 actually scheduled as the last speaker of the morning  
8 program, is Steve Kraft of the Nuclear Energy Institute.

9 MR. KRAFT: Well, good afternoon. Those of us involved  
10 in this program come to Las Vegas a lot. This is a tough  
11 room. I was watching some of my colleagues before me make  
12 their presentations, and I went out looking for a hard hat.

13 When last I had the pleasure of appearing before  
14 this Board, I was not an employee of the Nuclear Energy  
15 Institute, because there was no Nuclear Energy Institute.  
16 The Nuclear Energy Institute sprang into being on March 16th  
17 of this year, as a merger of the American Nuclear Energy  
18 Council, Nuclear Resources and Management Council, U.S.  
19 Council for Energy Awareness, and the Nuclear Division of the  
20 Edison Electric Institute, where I was employed, and Chris  
21 Henkel, who's here with me today.

22 In pursuing this program, following the DOE program  
23 and related matters for many, many, many, many years, we were  
24 engaged in a forced march, I might add, from Seventh Street  
25 to Eighteenth Street Northwest in Washington, D.C.

1           The Nuclear Energy Institute--I guess, a minute or  
2 two--is responsible for nuclear energy industry policy,  
3 providing a unified policy for the consideration of boards  
4 such as this, other government activities, providing  
5 information, et cetera. Our members are broader than the  
6 membership that I used to represent at EEI, and not only  
7 includes all the nuclear powerplant owners in the United  
8 States, it includes most of the supporting nuclear industry,  
9 plus utilities and suppliers worldwide.

10           I want to thank you for holding this very, very  
11 important and timely meeting at this date. I agree with both  
12 what Mal Knapp said, and what Steve Frishman said--it's rare  
13 that I agree with Steve, but I will agree with him on this  
14 one point: The PPA, which we now know as the PA, which began  
15 life as Scenario A, is a work in progress. Our views of that  
16 program, of that performance plan is itself a work in  
17 progress, and so, I was taking furious notes during the  
18 discussion as I learned more and more and more and more about  
19 this during the course of the discussion, and so I will be  
20 using my view graphs as a starting point, but will discuss  
21 some other matters as they now seem to be being presented.

22           A brief history lesson. We have been involved,  
23 from the industry standpoint, in this process since the  
24 beginning of time. It is my life. I like to kid my wife, I  
25 knew nuclear waste before I knew her. I certainly knew

1 nuclear waste before I knew my children. The only thing in  
2 my life that--the only thing, as we've learned, the only  
3 thing in history that has actually gone on longer than  
4 nuclear waste is baseball. I don't mean the game, I mean the  
5 film, "Baseball."

6           Okay, should I knock off the jokes? It's after  
7 lunch. Thank you, Mr. Chairman, for asking me to appear. I  
8 hate getting up in front of a crowd that's going, "Go on, get  
9 it over with. I want to go eat."

10           Anyone can write letters to DOE. A lot of people  
11 have. These were our set of comment letters. The only  
12 reason we list them here as demonstrating our bona fides in  
13 this process is they are, of course, the milestones by which  
14 you measure your involvement, but I think everyone knows,  
15 especially the DOE people, that we have been an active  
16 participant in developing this entire waste program, and,  
17 certainly, in the suitability process for years and years and  
18 years, and, in fact, a lot of the work that was engaged in in  
19 the recent several four or five years, particularly Jean  
20 Younker's work in early suitability assessments and what have  
21 you, I think, grew out of the critical comments that we made  
22 over time about the need to have that kind of analysis going  
23 on in the program.

24           I remember very well a situation going back to  
25 around 1985, where we were trying to get the Department of

1 Energy to understand the need to do performance assessment-  
2 type analysis, which you call now performance assessment, and  
3 we were suggesting that there must be some way a model could  
4 be developed to do this kind of assessment, and I won't name  
5 names, but individuals in the program at the time, some of  
6 whom are no longer in the program, said, "Well, we don't know  
7 how to do that. We're going to collect all of the data, and  
8 at the end of this huge process, we will then make a final  
9 determination of suitability, or whatever the law requires,  
10 and if you want us to do that, industry, you've got to go do  
11 that."

12           So, EEI got together with EPRI, and I think most of  
13 you know this history. In under a year, for under a million  
14 dollars, we wrote the first performance assessment model.  
15 Now, that's not to say it was the only, or the best, but it  
16 was the first, and the thing that I know, from talking to  
17 people in the program, is that a lot of folks in the program  
18 and in the contractor community in the program kind of  
19 learned from that process, maybe there are ways that this can  
20 be done.

21           I think it's interesting, and you should keep in  
22 mind that 960 is not just a technical process, it is a legal  
23 process, and we've been through the courts once, and, as  
24 Steve Frishman reminded us, the court said it is not a  
25 reviewable matter until the Agency acts, and that is an

1 important point that I will come back to.

2           Comments on the draft process. We, of course,  
3 filed a letter with Dr. Summerson, in fact, two letters in  
4 the recent history, and we said that we generally support the  
5 process. Jane, we're going to amend that. We have been  
6 sitting here, my colleagues and I, listening to the give and  
7 take of the discussion, and while I'm not saying we don't  
8 support the process, we just don't know anymore.

9           There has been a lot of very interesting discussion  
10 this morning, particularly in the peer review part of the  
11 process, that we're a little uncertain of now, and we want to  
12 go back and re-think our comments, and since this is not a  
13 legal proceeding, I would assume it is ongoing activity, that  
14 DOE's open to receiving future correspondence on that point.

15           Furthermore, as I will get into, the discussion,  
16 particularly in some additional points I want to raise beyond  
17 what we've already told DOE, we were contemplating filing a  
18 supplemental response anyway.

19           First point. Part 960 must be conformed to the  
20 current statutory framework. We have made this point over  
21 and over and over again. Steve referred to it in his  
22 presentation this morning. We appreciate the program's  
23 willingness to reconsider that matter. Just let me make the  
24 point again.

25           The guidelines were originally developed largely

1 for use in site comparisons, not exclusively so, but largely  
2 for that. The amendments in '87 said, "Go do Yucca Mountain  
3 exclusively. There is no need for comparisons anymore." I  
4 think everyone would agree. And there is, in fact, equally  
5 the need now for DOE to establish in some manner, preferably  
6 by rulemaking, clear and unambiguous guidelines as to what it  
7 is they're going to do.

8           They need to reflect the current statute, and they  
9 need to reflect their intent of what they're going--how  
10 they're going to proceed. If you do not do that, you're  
11 going to end up in--the decision, suitability decision is  
12 coming in the year--the overall suitability decision comes in  
13 the year 2000. If you go to the last page of Jane's  
14 presentation, is called, in parens, (The Final Agency  
15 Action). For those of you who are not lawyers, those are  
16 code words meaning reviewable by the court.

17           So, the point that we are making here is what do  
18 you want to have reviewable by the court? Do you want to  
19 have reviewable the decision and the application of the  
20 guideline, which certainly will be reviewed. Do you also  
21 want to have reviewed how DOE handled the guidelines?

22           Well, probably you will have to do that, but you  
23 will be in better shape, DOE, if you do something now to  
24 conform your guidelines to the statute, and I'm not talking  
25 about the substance of the guidelines, I'll deal with that in

1 a minute, I'm talking about the process, and before people  
2 say, "Well, you'll delay an already delayed process," since  
3 the court has already said this is non-reviewable, DOE is a  
4 competent agency interpreting their own regulations.

5           They can use a procedure in the Administrative  
6 Procedures Act that permits an immediately effective,  
7 interpretive rulemaking that says, "Here's the way it's going  
8 to go," not just something published on a blank piece of  
9 white paper that gets sent out for comment, but something  
10 that gets codified in your rules. We believe it will be  
11 much better, and, Steve, in your reconsideration of that  
12 issue, we ask that you take that into account.

13           But, what we think happens is you solved some of  
14 the problems everyone was talking about. If you've read Mal  
15 Knapp's letter to Jane, and he didn't really make a very,  
16 very strong point about it in this morning's presentation,  
17 but what the import of that letter says, from the NRC  
18 standpoint--this is not what we're saying, I'm merely  
19 paraphrasing, I believe, what NRC is saying--NRC is saying,  
20 "Look, DOE, 960 is your business, but if you were to ask us,  
21 we think you are misapplying your own regulations."

22           So, we kind of look at that as sort of supporting  
23 the notion, on our part, that says, "Well, conform your  
24 regulations to what you're going to do." There is even a  
25 school of thought that says you don't need 960 at all, but

1 that, somehow, there is no technical reason for DOE to have  
2 its own set of guidelines, and perhaps you can just rely on  
3 the NRC guidelines. We don't think that's doable under the  
4 current statute. The statute clearly calls for guidelines  
5 not just for comparison, but that brings me to the second  
6 procedural point that I want to make.

7           And that is, while this is certainly not required,  
8 while you're conforming your guidelines, conform them to Part  
9 60. Get NRC and DOE on the same sheet of music, and not just  
10 like one of these negative bureaucratic non-statements, not  
11 inconsistent with, but the same notes on the same sheet of  
12 music. Ultimately, this is going to be the test.

13           Now, Dan Dreyfuss raised a very interesting point  
14 this morning, is that you don't want to wait until the year  
15 2004, after doing all the work, before NRC says, "Sorry, not  
16 good." Well, we're not asking you to do that. What we're  
17 asking you to do is continue the process, but doing it to  
18 what it says in Part 60, not what it says in Part 960. There  
19 are enough differences, in our view, for that to be  
20 problematic in the long run.

21           But even if you don't--and I'm very heartened to  
22 see that DOE and NRC are--appear to be improving the working  
23 relationship, formalizing some additional steps that need to  
24 be formalized in terms of getting--Mal called it a resolution  
25 point on issues, not necessarily closure. We would argue for

1 closure. There are ways you can come to closure. NRC can  
2 learn rulemakings, if necessary, on closing issues, but even  
3 if they just get to this resolution point and DOE has more  
4 confidence that what they're doing is correct, I think that  
5 becomes important and, of course, the involvement of the  
6 regulator, as we've learned over the years in our work with  
7 NRC in a reactor role, is, in fact, a very useful thing to  
8 have.

9           So much for the procedural things that need to be  
10 done. Now comes the substance. As we began to think about  
11 making this presentation, and were contemplating what we told  
12 DOE in our letters to Jane, we began to realize that we  
13 didn't do anything--and this is where we will definitely file  
14 some supplemental comments--we didn't do anything to link  
15 together what we see linked together, that no one else seems  
16 to be seeing.

17           We believe that in conforming all these regulations  
18 to each other, that there needs to be a wholesale rewrite of  
19 the way the regulations call for the determinations of  
20 suitability, of licensing, even in the EPA standard, and this  
21 is drawn from our work in the EPA standard, is that you don't  
22 forget about subsystem performance.

23           You need to know about subsystem performance,  
24 obviously. You need to know how fast the ground water

1 travels and all that sort of stuff, but the test ought not be  
2 whether you meet some subsystem performance number if the  
3 ground water doesn't travel more than X, or the climate  
4 doesn't change more than Y, or you're not within so many  
5 yards of the National Park.

6           I want to know who's going to write a technical  
7 report on that. I want to know how much you're going to pay  
8 him, because I'm going to do it and become rich and retire.  
9 That's an easy one, I hope.

10           The point is, that if you go to something like a  
11 biosphere model, like EPRI has developed--the IMARC Code is  
12 an example--where you actually look at real people at a  
13 natural site--Yucca Mountain, population in the area in the  
14 far future, those sorts of things--you are going to come up  
15 with, probably, a more realistic and more defensible idea of  
16 how the site is going to perform, and come up with the  
17 decision criteria that makes sense, but it goes beyond that.

18           It not only does that, it also eliminates a lot of  
19 the fighting that I heard this morning between and among the  
20 different speakers, and questions from--were implied in  
21 questions from the Board, the question of uncertainties. The  
22 model can be run in such a way that you assess uncertainties  
23 early on. I mean, this is nothing new to DOE. I think that  
24 they've got plans to do this, but, you know, you don't have  
25 to spend, in talking about investment decisions, you don't

1 have to spend a lot of money analyzing something that the  
2 model shows doesn't affect the dose to the average individual  
3 in the target population, even if that particular parameter  
4 swings wildly over time. I mean, why bother?

5           You're doing it now because you've got a subsystem  
6 performance requirement that says you've got to prove you're  
7 within some kind of narrow band, but if you eliminate those  
8 requirements and just deal with the overall effect, which  
9 related to the conversation that will take place later this  
10 afternoon, taking into account both natural and man-made  
11 barriers, then you end up with a more realistic view of how a  
12 site will perform, and, it becomes a management tool, it  
13 becomes a decision tool, it's also a science tool.

14           We believe this relates very closely to the  
15 licensing process, EPA standard, the one that does not apply  
16 now is, in fact, total system performance criteria. We think  
17 it's going to remain that way. Of course, we don't know what  
18 that other NAS panel is going to come out at, but at least,  
19 in fact, that you ought to review Part 60.

20           You're going to revise Part 60 anyway. I mean, the  
21 Panel's going to come out with its report, then the EPA's  
22 going to do its thing, and the NRC's going to do its thing,  
23 DOE's got to--I remember the first meeting, the inaugural  
24 meeting of that panel, and I will now give you my view of my  
25 interpretation of what happened at that Panel meeting, and

1 that's why I want everyone to start working on doing this  
2 now, and not waiting.

3           The Panel said, "Okay, we're here to learn." EPA  
4 got up and said, "We have a standard. When you guys get your  
5 report done, we'll think about it." NRC got up and said, "We  
6 have a rule. When you get your report done, and after EPA  
7 thinks about it, then we'll let you know." DOE got up there  
8 and said, "We have a program. When you get your work done,  
9 and after EPA thinks about it, and NRC lets us know, then  
10 we'll start the program."

11           Well, let's get it all done now. I mean, the  
12 conversation this morning, Dr. Brewer, was there's a time  
13 issue here. Yes, there is. Let's get the job done.

14           In conclusion--well, my talk wasn't that long, and  
15 pretty self-evident--you need to conform Part 60 to statutory  
16 framework. We think you need to do some more work under peer  
17 review process. We're going to talk with them in another  
18 filing. You need to also reflect the changing nature of the  
19 site characterization plan in the performance program  
20 approach, and then the biosphere model and limitation.

21           But let me just make another point that is not in  
22 any of this, and is really not on point to this Panel. What  
23 I can't--representing the industry, primarily utilities, I  
24 can't help myself from what I'm going to say. The  
25 conversation this morning convinces me even more, you need to

1 separate what's going to happen in the disposal world from  
2 what needs to be done in the reactor world, and the only way  
3 you do that is with a centralized interim storage facility  
4 someplace, so you can get the fuel off of our sites, where it  
5 belongs, and you guys can play all the fun and games you want  
6 at Yucca Mountain, and we're not going to stand here and say,  
7 "Get it done, because here comes the fuel."

8 (Laughter.)

9 MR. KRAFT: Thank you.

10 DR. ALLEN: Thank you.

11 Questions from the Board?

12 (No audible response.)

13 DR. ALLEN: Questions from the staff?

14 (No audible response.)

15 DR. ALLEN: I think we better move on, then, and as I  
16 understand it, although Jean Younker is on the program, I  
17 think you're going to lead it off, Steve?

18 DR. BROCOUM: I'm just going to say a few words. Jean  
19 is going to make a presentation on a lot of the detail, the  
20 more detailed questions the Board has asked us about the kind  
21 of information needed, where our uncertainties are, how we're  
22 going to get our data in time, and what the schedule is for  
23 the next few years, and this is basically a snapshot in time  
24 of the stuff that Jean is going to present today.

25 We're still in the process, as I said, similar to

1 the caveats I gave this morning about the five-year plan.  
2 We're still in the process of, you know, of working out our  
3 budgets, working out our schedules, putting the whole thing  
4 together, so this is basically work in progress, and we're  
5 doing detailed out-year planning, so you'll hear a lot of  
6 stuff from Jean today. It can change in the details over the  
7 next few months. That's all I want to say.

8                   Jean?

9           DR. YOUNKER: Good afternoon. I think I'm now hooked up  
10 here. I just told Steve Kraft that he's a hard act to  
11 follow, because at least he had a little kind of light humor  
12 in his discussion with us. I had the image of, "Here comes  
13 the fuel." You know, I could just imagine this caricature.  
14 It could be a really interesting little "Far Side"-type  
15 cartoon on that.

16                   I'm going to use both screens a couple of times  
17 during the talk, so I'm just getting myself started so I  
18 remember to do that.

19                   The Board proposed a number of topics, and a team  
20 of people worked long and hard to try to figure out how they  
21 could answer as many as possible in this representation in  
22 the time that's allotted. I'm not sure, I think we have  
23 about an hour, and I take it I should take the whole time? I  
24 assume the whole time is allotted.

25           DR. ALLEN: Except for what Steve already used.

1 DR. YOUNKER: Although we're starting late, so I'll try  
2 to watch the time.

3 The Board asked for some comments on what the waste  
4 isolation strategy, or I think some people refer to this as a  
5 safety concept, now looks like for Yucca Mountain, given all  
6 of the things that have been going on. What's the role of  
7 thermal loading in that strategy? What are some key  
8 technical issues associated with suitability and licensing?  
9 And, what significant features, events, and processes could  
10 impact suitability, and then, given all of the above, once  
11 you've explained that all to me, what are the priorities for  
12 analyses and information that flows out of that for the major  
13 program milestones.

14 And, as you might guess, trying to figure out how  
15 to pack this into an hour was quite a challenge, and so I  
16 think what I'll have to do as I move through this is to hit  
17 some high points in certain parts of the presentation, and,  
18 as you well know, some of the topics that I'm going to cover  
19 in three minutes are either--have been the topic of the whole  
20 meeting, or probably will be the topic of the whole meeting,  
21 so I think we'll just have to kind of economize on time.

22 I did ask a few specific people to be here to  
23 assist with questions in the areas where I'm certainly not  
24 the expert, which is almost everything in this whole  
25 presentation, so I will certainly call--hopefully, that will

1 be acceptable to you, Dr. Allen, to call upon a couple of  
2 people who would help with some of the things like schedules  
3 for ESF. I know those are topics that you may have more  
4 interest in than what I'm going to be able to deliver answers  
5 to.

6           What we put together, then, in terms of an outline  
7 is shown on this slide. We're going to tell you what the  
8 strategy looked like in the SCP. I know a lot of people keep  
9 saying, "We didn't know you had one," and we keep pointing to  
10 the SCP and saying, "It was there," you know, "It's in  
11 there," and, of course, it's hard to find it. People  
12 finally, in fact, internal to some of the organization that  
13 supports DOE, recently discovered it, and it was really--it  
14 was quite an awakening to see, "My God, it really was there."  
15 You know, we really weren't fibbing when we said it was  
16 there.

17           We'll tell you how we think that strategy has to be  
18 refined and at least some of the new thinking that needs to  
19 be put into perspective, take a look at the strategy and see  
20 whether it does need to be changed, and then we'll talk about  
21 the key elements or components or the mechanisms of that  
22 strategy, walk through every one of them--and this is why I  
23 said I'm going to have to kind of hit the high points of what  
24 do we know now, what do we see as the key uncertainties, and  
25 what's our best plans, or kind of the highlights of our plans

1 for reducing some of those uncertainties.

2           And then, given all of that, in the same way I  
3 think you tried to lay out in your agenda topics, we'll try  
4 to put the priorities, at least in the--I think we have a  
5 pretty good explanation and division of our priorities  
6 between now and technical site suitability. I think you'll  
7 see that most of what I say beyond technical site suitability  
8 really still offers our PPA, or PA now, thinking, and doesn't  
9 go into much more detail than what you've already heard  
10 before, so let me just say that the focus is on our thinking  
11 to 1998, with a little bit of additional thought applied  
12 beyond that time.

13           Okay. Now, just to convince you, I know this  
14 probably is going to bore some people who were there, in  
15 fact, in the time when we gave these briefings, but this  
16 little hub down here tells you when the slide was prepared,  
17 and we did do some public briefings right after the SCP was  
18 issued in January of 1988, and this top-level strategy slide,  
19 as well as the two that follow, are taken directly, without  
20 change, from those briefings.

21           The strategy places primary reliance on low flux,  
22 slow water movement, and long radionuclide transport times in  
23 the unsaturated zone, looking at the low probability,  
24 potentially disruptive processes that could have significant  
25 impacts. You're going to have to identify and characterize

1 those, and, finally, move on to pre-closure, the pre-closure  
2 component of the overall safety strategy. At that time, our  
3 main focus was seismic hazard and seismic design, but we said  
4 we'll do the appropriate work to characterize the hazard.

5           These were the objectives that were stated, and I  
6 did give you the reference, in case you want to check me out.  
7 Section 8.0, pages four through nine, you'll find these  
8 highlighted. These objectives are actually the titles of  
9 sections: Engineered barrier system objective, limit  
10 release; natural barrier system objective, provide long  
11 radionuclide travel times; and pre-closure disposal system  
12 objective, obviously, safety is a key, as was pointed out  
13 earlier this morning, and that construction doesn't  
14 compromise the ability of the facility to meet the other  
15 requirements, so you always have a concern, even at this  
16 point in time, when we're thinking about the need to think  
17 ahead to make sure you didn't do something that could  
18 potentially impact later performance.

19           Okay. This next one is the one that really sums it  
20 all up, and I won't go through every detail of it. I'll just  
21 point out a couple of items on it, and this--reminding you,  
22 once again--this is still from that same briefing, and what  
23 we showed in this one was that you could break the overall  
24 strategy into the engineered barrier, and the components of  
25 that engineered system at that time, in our conceptual

1 design, for pre-closure as well, and then for the natural  
2 barriers of the post-closure system, and the key thing I  
3 wanted to point out with this, I think as you read through  
4 these, you will find a few places where--and I'll point these  
5 out in the next chart--where we've learned something, which  
6 you would hope, after the number of years that have passed,  
7 that will put this in a slightly different perspective, but  
8 as the team that helped me put this presentation together  
9 challenged each other on this, we found that it was really  
10 quite robust, quite robust, and I think I'll be very  
11 interested to see whether the reaction from the audience is  
12 similar.

13           The main thing I want to emphasize here is that  
14 within the engineered barrier system, you see listed  
15 unsaturated rock/air gap, and one of the concepts which I  
16 think was strongly underlying the strategy of 1988, and I  
17 think still does today, is that the very setting that we've  
18 chosen to look at as a potential repository limits the water  
19 available to contact and corrode the canisters. So, even  
20 though that's not, in a sense, what we think of in some of  
21 our current thinking as an engineered barrier, that whole  
22 idea that the low flux setting then allows the engineered  
23 system to perform in what we think could be a very  
24 advantageous way was a highlight of this strategy as we put  
25 it together in pre-1988.

1           I think the rest of this, if you read the  
2 objectives of the components, they will fit right in with  
3 what I'm going to continue to say here.

4           Okay. What about the refinements between 1988 and  
5 1994? Well, I think, very clearly, even early in that time  
6 period, or certainly a lot more recently, I think we have  
7 increased recognition of some fast flow paths in the site. I  
8 think you've heard presentations recently that suggest some  
9 pulses penetrate deep. We don't know what percentage of the  
10 total transport of water through, percolation flux through  
11 the system travels those fast flow paths, and that's clearly  
12 going to be a key topic that we're going to have to  
13 understand in order for the site to move forward.

14           The now explicit focus on the contribution that  
15 thermal loading could make to system performance is a  
16 refinement, I think. It's there in our discussions in the  
17 site characterization plan. It's really not a part of the  
18 top level strategy, but if you look over in the engineered  
19 barrier, the waste package sections of the SCP, we were  
20 beginning, at that time, and, certainly, the Livermore people  
21 who had contributed to that part of the site characterization  
22 plan had begun to think about the potential high value if you  
23 really could dry the rock out, use the heat as a part of your  
24 engineered system, dry the rock out, and have a predictive  
25 capability on how long that would stay dried out that you

1 could use as a part of your safety case or isolation concept.

2           So, it's there in the reading, but, now, of course,  
3 given a lot of discussions that you've already had with us,  
4 and I think we're going to have a meeting this fall, I  
5 believe, that will focus on that topic, with you.

6           Multipurpose canister as a potential waste form is  
7 certainly something new since the 1988 strategy was  
8 developed. Given that you have the multipurpose canister as  
9 a waste form, then you get--you look at your placement  
10 options, and of course, we have a reference case for a  
11 vertically-emplaced canister in the site characterization  
12 plan, and now the in-drift emplacement appears to be, you  
13 know, the reasonable mode, at least for the large MPC, and  
14 that also gives you some options for what you might do if you  
15 want to use enough packing material, pack backfill of sort,  
16 or air gap options.

17           And then, the whole dose-based standard, the  
18 remanding of Part 191, and the order for the EPA to go back  
19 and develop something that will be dose-based gives us a  
20 greater role for the saturated zone. I think many of us  
21 suspected that, and you'll find places in the site  
22 characterization plan where there are some caveats applied  
23 that, you know, with appropriate characterization, the  
24 reliance on the saturated zone that was not very high in the  
25 original strategy might be something that would give you at

1 least some additional conservatism.

2           And then, the consideration now, very recently, and  
3 the program approach that is now being implemented is the  
4 possibility of an extended, or at least the ability to extend  
5 the retrieval period if you decide that that's a prudent  
6 thing to do.

7           All right. One of the--I'm not going to hot  
8 topics, I'm not going to say that. One of the topics of this  
9 is, I know, is what the perspective is, given this waste  
10 isolation, kind of updated strategy from the site  
11 characterization plan, how does the approach to thermal  
12 management, thermal loading fit into that, and I think the  
13 best we can do for you right now is to give you this kind of  
14 an explanation, and that is that our plan is to maintain  
15 flexibility in the design to allow modifications that could  
16 eventually improve system performance.

17           That means you're going to take the approach, as  
18 you would in any good engineering design, identify your key  
19 environmental parameters and your design parameters, and then  
20 define the envelopes for those key parameters.

21           That means that when we get to technical site  
22 suitability, where will we be with this process? Well, we'll  
23 talk a little bit more about what our vision is of what the  
24 database will be supporting the technical site suitability  
25 evaluation, but from the standpoint of thermal loading, I

1 think we believe that there will have to be a reference  
2 thermal loading based on the current design concepts at that  
3 time, and then we'll have to look at sensitivity to the range  
4 that's under consideration.

5           As far as the licensing strategy goes, it continues  
6 in the same mode in that you will determine--and, in this  
7 case, now, we're really getting into the phase of  
8 establishing licensing conditions--the range of conditions  
9 over which the designs work. We'll use the performance  
10 confirmation, perhaps the extended performance confirmation  
11 period if that's chosen to be implemented to show we are  
12 within those conditions, and then modify the strategy, as  
13 needed, to improve performance as you go through that period.  
14 Clearly, you'll be going and negotiating with the regulator  
15 and determining if the new information suggests that you can  
16 make some changes that will make the system work even better.

17           Okay. So, in a nutshell, to kind of restate where  
18 I think we are--and I think if you look in the five-year  
19 plan, the Executive Summary, in fact, I took these words  
20 pretty much from that Executive Summary, so it should mirror  
21 what you read there, with a lot more words, of course.

22           The top-level waste isolation strategy. Establish  
23 bounds on water contacting the waste packages as the ultimate  
24 limit on your non-gaseous releases; develop a long-life waste  
25 package that will last at least a thousand years as your key

1 to your early repository safety arguments.

2           Then, establish the bounds on waste form  
3 dissolution and transport for your plus one thousand year  
4 safety arguments or safety case, and then, of course, with  
5 the dose-based data, we have to look at the dilution that you  
6 will be able to rely on in the aquifer to predict the actual  
7 doses.

8           Okay. Now, this is the part where I said we'll  
9 walk through each of the key mechanisms or components of this  
10 strategy, and, in many cases, there's a lot that you could  
11 say about this--perhaps not me, but other people could say a  
12 lot more than I could say, so I'm going to hit a few high  
13 points, just refresh your memory, in some cases, of things  
14 that you've already heard, talk about the key uncertainties,  
15 and then kind of highlight some of the plans for resolving  
16 those uncertainties.

17           So, to break this out into components now, and this  
18 is kind of just dissecting that previous strategy, the dry  
19 environment around engineered barriers provided by the  
20 unsaturated zone is kind of the first component that we'll go  
21 through; the robust engineered materials, our evidence for  
22 and our uncertainties about dissolution of waste matrix and  
23 the solubility of radionuclides, the slow release of them  
24 through the engineered barrier, and then the transport  
25 through the geosphere.

1           Okay. Now, at this point, I'll give you something  
2 to look at besides words. We've dreamed up a little cross-  
3 section for you to think about as I'm walking through these  
4 various parts of the strategy.

5           Just so you have the picture, basically, the low  
6 ambient flux is the first one we're going to talk about, the  
7 dry environment; then stepping into robust canister, and this  
8 one's clearly focused on spent fuel, but we know we have  
9 another waste form to deal with; the possible packing  
10 material. This is an option that's not--I don't think it's  
11 in the reference design thinking at this point, but it's  
12 certainly something that hasn't been ruled out, and then, of  
13 course, the geosphere.

14           So, on the dry environment, then, what are a few of  
15 the key things about our current understanding that we might  
16 not have been able to say in 1988 is kind of the way we  
17 looked at this as we prepared, because we didn't want to try  
18 to rehash, you know, the whole Chapter 3 of the site  
19 characterization plan talks about what we know about the  
20 unsaturated zone at Yucca Mountain, or at least a good share  
21 of it, so, kind of what have been some key things.

22           Well, I think one thing that you've heard about and  
23 that we think is really important is we're getting a better  
24 understanding due to some of Alan Flint's work on the spatial  
25 distribution of infiltration rates, and that, I think, starts

1 to give you an understanding, at least, of your upper bounds,  
2 what kind of upper bound you have on infiltration, given  
3 changes in climate, given changes in exposure of materials,  
4 so that's one that I think we all believe is one that's  
5 making some advances in our understanding.

6           Certainly, some of our unsaturated zone hydrologic  
7 modeling has been a basis for and used as part of our total  
8 system performance assessment, has helped us to get a better  
9 feeling for the importance of exactly how we cast the  
10 fracture matrix system. I think we all knew that. We always  
11 waved a flag and said, "That's going to be really important,"  
12 but I think we have hard evidence now of just how important  
13 that is.

14           The old age of matrix groundwater, this one you'll  
15 see coming up within this presentation on both sides. It's  
16 something we're getting a handle on. It's also something we  
17 have some real uncertainties about, because we are getting  
18 some mixed signals in terms of the ages of groundwater, and  
19 that's what's leading to the point I made earlier about our  
20 recognition of the deep pulses.

21           All right. Moving on with the key uncertainties,  
22 some of these tend to kind of focus on the key uncertainties  
23 that we hope we'll get at in the near time frame. You'll see  
24 a mixture. As I was going through this today, I found that  
25 there were a few things I'd left out if I went to the longer

1 perspective, so don't think that I'm necessarily complete if  
2 I'm thinking about the longer time perspective out to 2001 or  
3 2008, but we tried to at least get at some of the things that  
4 we know that are key for the technical site suitability.

5           Similarly, as we get underground, one of the key  
6 uncertainties is how much actual seepage, how much inflow  
7 will we see? That's going to be a really important piece of  
8 information to us in our understanding of that site.

9           Here is where the age of the water comes up, the  
10 young age of some of the deep unsaturated zone groundwaters  
11 that we've detected. Another, clearly, a key uncertainty  
12 will be the effect on whatever thermal load we finally choose  
13 as our reference case for suitability, and, in the future,  
14 beyond that, on how flux will be redistributed and how much  
15 additional flux you have to then take into account when you  
16 do your performance assessment modeling.

17           I'm sorry I cannot go through every point, but I  
18 know if I do, I just won't make it in the time we have, so if  
19 I skip one that's a favorite, please feel free to zing me.

20           Okay. Plans for reducing uncertainties. The  
21 continued infiltration monitoring is clearly one that will  
22 lead to further understanding in the spatial distribution  
23 infiltration. The observations in the ESF, we're doing a  
24 fair amount of just sample collection and analysis every time  
25 the TBM advances, and that kind of type of chemistry that

1 we'll be doing, as well as the radial borehole testing that  
2 will be going on in the early testing alcove should give us  
3 some additional insight very early into the hydrologic system  
4 that we really couldn't get any other way.

5           Looking at variation in matrix saturation, the ESF  
6 will be important; behavior of seeps, once again; and the one  
7 key area that we're really beginning to focus on is comparing  
8 what we see with what we've predicted we would see. That's  
9 going on in both the surface-based program, as well as now in  
10 the ESF, where using the 3-D geologic models, and looking at,  
11 in the case of the surface program, looking at previous  
12 borehole saturation profiles, for example. The scientists  
13 are now getting very aggressive about predicting, and then  
14 testing their understanding by seeing how well they do with  
15 those predictions when they can get to them either in another  
16 drillhole, or in the ESF, when we get that opportunity.

17           Some of the long duration thermohydrologic testing  
18 in the ESF. Now, this is going over past technical site  
19 suitability, because, clearly, we won't have that kind of  
20 information at the time the 1998 determination is scheduled.

21           The hydrogeologic modeling that we're doing and we  
22 will continue to do is going to help, I think, reduce  
23 uncertainty in terms of how to represent the various  
24 processes and the scales of those processes. Probably the  
25 most important here is the scaling, and then some lab testing

1 is going to help out, too, of course.

2           All right. Let's move to number two, the waste  
3 package materials, and those of you who know my background,  
4 know that this is not my area. I'm a geologist. I'm very  
5 comfortable talking about the geotechnical materials. The  
6 engineering part, I probably--I look over at the engineers on  
7 the Board and say I'm probably going to misuse some words  
8 here, so, you know, just be tolerant with me.

9           Basically, we've had a really important degradation  
10 mode study where the literature has been reviewed to attempt  
11 to figure out for the list of candidate materials that we  
12 have at this point, what kinds of failure modes or  
13 degradation modes have to be looked at, what should we be  
14 expected to deal with.

15           Now, we're moving toward designating the most  
16 appropriate materials for both inner and outer barriers.  
17 Here are some primary and secondary choices that are under  
18 consideration at this point in time, some crack growth  
19 studies or corrosion resistant materials underway, giving us  
20 some early indications; planned, and I think just barely  
21 underway, some thermogravimetric testing of corrosion  
22 allowance materials, and I'm not real familiar with this part  
23 of it, once again, so if we have questions, we'll just ask  
24 the people who are here who can really elaborate; and then  
25 some observations that we have kind of coming in from the

1 reacting mode on cladding life.

2           One of the key uncertainties clearly comes back to  
3 the near-field environment, what kind of near-field  
4 environmental range of conditions do we have to design that  
5 robust canister to occupy. What will corrosion rates look  
6 like under the kind of variable humidity and temperature that  
7 the canister will experience? Pitting corrosion is the  
8 biggest concern, and what kind of pitting corrosion will we  
9 experience with the kinds of corrosion-resistant materials  
10 that we're looking at, even to the extent of the zircaloy  
11 cladding, and another one that's become very important  
12 recently, I guess, with the WIPP experience and with our  
13 understanding of what the waters look like in terms of  
14 microbial content is the microbiologically-induced corrosion.

15           And, what will we do about that? Well, on this  
16 side, clearly, I think I've already said this, and you're  
17 going to start to see a theme here, we'll have to have a  
18 range of near-field environments that are within--that fit  
19 the information that is available at that time when we go  
20 into a technical site suitability evaluation, and at the time  
21 of the 2001 construction authorization application.

22       DR. CANTLON: That's 1998, not '88, isn't it?

23       DR. YUNKER: Yes, I think you're right. Sorry for the  
24 slip there. I was probably slipping back in time, thinking I  
25 was really doing a site characterization plan.

1            Modeling and testing of pit corrosion processes  
2 will be carried out, and we have a little bit of information,  
3 I guess, that might be applicable, coming in from analogs  
4 where you can look at some iron materials and copper  
5 materials that have been in the environment for a long time.  
6 The actual applicability to our conditions, I think, is a  
7 question to both people who are looking at this, but it still  
8 gives us a handle on how materials last in the different  
9 environments, and, then, clearly, we're going to have to look  
10 at the microbiologically-induced corrosion.

11            All right. Now, we're at the waste form and the  
12 early mobilization step, and we have some spent fuel  
13 oxidation and uranium oxide and spent fuel dissolution  
14 experiments for a range of possible environments; solubility  
15 experiments for a range of possible near-field environments;  
16 and some data on glass dissolution and alteration, and this  
17 is the area where I think, from talking to the experts in  
18 this area, we probably have a ways to go in terms of really  
19 getting a broader and more convincing database.

20            One of the key uncertainties, oxidization state of  
21 the spent fuel that would be coming into the system. This  
22 whole question of how much of the cladding would be breached,  
23 and how much will still be a non-degraded form, such that it  
24 will add at least conservatism, even if it's never taken into  
25 account as a part of the engineered barrier system, per se,

1 quantitatively, we certainly suspect that the more we know  
2 about it, the better off we are in terms of using that as a  
3 conservative, you know, another element of your multiple  
4 barrier concept.

5           Waste form dissolution rates in the presence of  
6 limited water, you'll see a theme here all the way through.  
7 I think the uncertainty that keeps coming through as you poll  
8 the people who are looking at this is, what does that limited  
9 water environment that could be very good, what does it do to  
10 us in terms of our ability to fully measure the rates at  
11 which things will happen, like diffusion, or like  
12 dissolution. Obviously, it makes it very hard. It's not new  
13 to you, but I'm pointing it out again just to remind where  
14 there, because it could be a very good environment, this also  
15 makes it a very difficult place to characterize and get the  
16 information you need to then do your predictive modeling.

17           This whole question of waste form colloids, I  
18 think, was addressed at one of your previous meetings, as I  
19 recall. The question of their existence now is pretty clear,  
20 but how stable are they, what will happen to them, you know,  
21 over a very short distance from the time they come off the  
22 waste form, we really don't have much information yet on  
23 that.

24           And then, of course, some solubilities for  
25 neptunium and technetium for the near-field environment, we

1 have some already, and I think some of the initial ones are  
2 going to be helpful, especially under less humid conditions,  
3 less water.

4           Okay. What sort of plans for reducing? Establish  
5 conservative but realistic assumptions for cladding  
6 performance. I think that's an indication that my sense of  
7 talking with people is we're probably not heading for enough  
8 focused work in this area to take full credit for the  
9 cladding, but we probably are going to be able to get enough  
10 of a handle on it to at least use it as a conservative part  
11 of our argument.

12           Waste form dissolution testing; clearly, underway,  
13 using the low saturation drip test approach, which I think,  
14 once again, illustrates how hard it is to make the kind of  
15 measurements you need to make.

16           As far as waste form dissolution, look for  
17 conservative but realistic values. Our total system  
18 performance assessment, I think when you heard that  
19 presentation, you know that, in this area, we have some  
20 concern about whether we were really very realistic in the  
21 way we got rid of our waste form.

22           Colloid investigation strategy, you've heard that  
23 presented before, to really focus on the key radionuclides  
24 and determine whether colloids play a role in their  
25 transport, and then the solubility experiments that we

1 already mentioned.

2           Okay. Now, we're up to the engineered barrier  
3 system, which is some part of either an air gap, maybe some  
4 packing material, and then, presumably, the material down  
5 here, assuming that we have the possibility for anything that  
6 ever does get out to move down through this material, so,  
7 basically, the slow release, current understanding, kind of a  
8 theoretical basis for thinking that we probably won't see a  
9 lot of inflows into a large opening in an unsaturated  
10 material, but you do have the counter argument of, well,  
11 yeah, but we do see some fracture flow in some of the tunnels  
12 at Rainier Mesa. You've heard that information presented,  
13 so, clearly, this one has some uncertainty in it that comes  
14 up on the next slide.

15           Considerations of advective flow through capillary  
16 barriers, you've heard discussions about the potential in the  
17 unsaturated zone for using capillary barriers as an air gap,  
18 per se, as a fundamental part of your system; and then,  
19 measurements of diffusion rates in partially saturated media  
20 area leading to, I think, some sense that the diffusion rates  
21 will be extremely slow. There are uncertainties, of course.

22           One of the uncertainties that's key is the per cent  
23 of waste package surface degraded to expose the waste; as far  
24 as the diffusive release goes, potential for continuous  
25 liquid film to support diffusive release. If you don't have

1 that, then you're probably going to have very slow potential  
2 for release; and then, of course, our overall strategy and  
3 layout for our schematic up here, what does that really look  
4 like.

5           Okay. What are we going to do? We're going to use  
6 a range of designs for the 1998 technical site suitability  
7 evaluation. We're going to certainly look at seeing how much  
8 inflow we have in the ESF, laboratory measurements of  
9 diffusion rates. We are looking, will look at whether some  
10 kind of packing material like we've schematically shown over  
11 here could be used.

12           You've heard, in the total system performance  
13 assessment presentations, that you sure have to be careful  
14 about that from the potential of lowering your, or causing  
15 your package to overheat, basically, just because if you put  
16 something around, maybe if it's just down here, it won't be  
17 such a problem, but when you backfill, you know in our  
18 modeling results, we caused our packages to get a little  
19 warmer than what you would like; and then, sensitivity  
20 analysis of a range of drift-scale thermohydrologic models.

21           Okay. Moving up to the geosphere, what do we  
22 understand about it? Well, this one now throws us back to  
23 the initial view graph. We talked about spatial distribution  
24 of infiltration rates. Clearly, that kind of gives us an  
25 upper bound on what's going to happen in the geosphere from

1 the standpoint of the amount of flux coming through the  
2 system, so both of these two you've already heard about. The  
3 same thing with understanding the overall flow through the  
4 system.

5           There is some very interesting information put  
6 together for the ACNW meeting coming up here, I guess it's  
7 next week, that kind of puts all of our data together on  
8 groundwater and paleo-groundwater dating, and I think John  
9 Stuckless, from USGS, will be making that presentation. It  
10 tells a very--I think, begins to be a coherent story about  
11 what the flow processes look like, travel times, as well as  
12 how high the water table may have ever been in the previous  
13 climatic--under previous climatic conditions, and so, I think  
14 we're getting some real understanding of that part of the  
15 system, it looks to me.

16           Once again, the laboratory measurements of matrix  
17 imbibition and matrix diffusion. You've heard about our  
18 measurements of retardation, and then one last one here that  
19 becomes important, because we are talking about now being  
20 able to adequately characterize the saturated zone, is  
21 hydraulic gradients in the saturated zone, and, specifically,  
22 you all know the question of the steep gradient, and whether  
23 that really has any potential for causing a problem for us,  
24 whether it's just a part of the overall system that is just a  
25 feature that has a clear explanation. It's going to be

1 important to us in, I think, the overall credibility of our  
2 understanding.

3           Okay, uncertainties. Once again, thermal loads on  
4 percolation flux. How much refluxing, or how much additional  
5 flux do we have to take into account, based on the thermal  
6 load that we choose.

7           Young dates for some of the deep unsaturated zone  
8 groundwater. This question comes down how much of the total  
9 flow through the system could be traveling along those fast  
10 paths, and we talked about that in the groundwater travel  
11 time discussions that we've had with you all and with the  
12 NRC.

13           Conceptual model of fracture-matrix coupling in  
14 partially saturated media; clearly, you all know this is a  
15 key, exactly when the fractures will carry fluids given  
16 partial saturation.

17           Effect of long-term transient infiltration rates  
18 due to climatic change; response of the system to climatic  
19 changes, how much the water table position could change is  
20 obviously a key uncertainty, and, as I mentioned, I think  
21 that is one that, through some of the work that has been  
22 pulled together, I see in this ACNW presentation some real  
23 beginning of a really good understanding of the system.

24           The dispersion caused by heterogeneity in the end,  
25 the geosphere that we have to model, and then, once again,

1 the steep gradient.

2           Okay. What are we going to do about the  
3 uncertainty? Obviously, do as much as we can to understand  
4 where the seeps are coming from and how old they are. We  
5 have the tracer experiment set up to go. I think at least in  
6 '95, certainly by '96 we'll get some good results from that.  
7 Sensitivity analysis, once again, of the range of flow and  
8 transport models that fit the current information base.

9           This is one I know you have interest in, the Calico  
10 Hills question of how we characterize it, what experiments we  
11 do, if we do in situ experiments, whether we do a drilling  
12 program is one that we're going to take a very hard look at  
13 this year in a systems study. I look at it as kind of a, in  
14 a sense, an update of the Calico Hills risk benefit thinking,  
15 at least, not the whole report, necessarily, but we need to  
16 take a look to see if the answers that we got in that are  
17 valid, how they fit into the new way that we're looking at  
18 the program.

19           We do have some boreholes planned to investigate  
20 the steep gradient, and then, one thing I didn't put on here,  
21 and I added when I was going through this. I think if you  
22 look at the broad set of tools we're trying to use to get a  
23 handle on future climates, I think it's worthy of mention.

24           There's really a wide set of things you can do.  
25 Some of them are kind of esoteric, from a geologic viewpoint,

1 but I think we really are closing in, I think, on some  
2 packages of tools from the standpoint of the marsh deposits,  
3 and looking at the kinds of organisms that inhabit them, you  
4 know, looking at modern environments. There's a lot of  
5 things we can do there at least to get some better confidence  
6 in our bounds on the climate.

7           To sum this all up, then, in terms of where the key  
8 uncertainties seem to be related to the waste isolation  
9 strategy safety concept that we've presented to you, it looks  
10 to us like there's probably a set, a list like this--and, you  
11 know, if you drop down a level, of course, the list expands,  
12 but to try to roll it up into something that we could talk  
13 about here, it's no surprise to you that we think the  
14 percolation flux distribution through repository horizon is  
15 one of our key uncertainties. That certainly comes out of  
16 our performance assessment modeling, and it comes out of any  
17 hydrologic modeling that you would ever see anyone do.

18           Saturation in and around emplacement drifts, the  
19 material degradation and dissolution rate of spent fuel in  
20 this low saturation environment, diffusion rates in the low  
21 liquid saturation environment; once again, that whole  
22 question of how do you get a handle on the rates when you  
23 have--your expectations are there will be very little fluid  
24 there. Fracture matrix interactions in flow and transport,  
25 exactly how we characterize that, and then our dilution

1 expected in the saturated zone.

2           There's a few other important things that didn't  
3 make it into the strategy discussion in the way that we put  
4 it together, so I want to make sure that you knew that we  
5 know they're important. We don't really think they're as  
6 important as the key uncertainties that we highlighted, but  
7 in the pre-closure part of the overall safety of the system,  
8 clearly, there's some concerns about how much usable host  
9 rock, and how good is--how constructable is that host rock.

10           We have a major effort going on in our seismic  
11 hazards and design basis work with the topic going forth in  
12 our interactions with the Nuclear Regulatory Commission on  
13 that, and some specific characterization driven from that,  
14 much of it already done, but some yet to do.

15           And then, given the consideration of the extended  
16 retrievability period, what kinds of potential rock stability  
17 problems do we bring on if we try do that, and that's  
18 something that we're just very, very recently getting some  
19 handle on, and in that, I might add that I think people do  
20 have some concerns about that. We do have to really take a  
21 good look at this.

22           And then you asked about the alternate regulatory  
23 criteria, and its impact, and we've already told you  
24 everything that we have to say about that in terms of DOE's  
25 feedback to the Academy Panel, and so, about the only thing

1 to remind you here, I guess, is just that, clearly, the time  
2 frame is going to be a key part of the answer, and then it  
3 leads us back to a need to really get a handle on the  
4 dilution that's reasonably expected in the saturated zone.

5           Okay. Now, given all that, where does it leave us  
6 in terms of priorities, and how does that data flow to the  
7 key milestones? So, now we're at the shift-over point here  
8 to say, what does our program look like.

9           Okay. If you kind of take a overview look with me  
10 for a moment at the testing priorities, and I really, in this  
11 part of the talk, I really didn't get a chance to look at the  
12 design and I didn't bring in much in the performance side of  
13 the program. I really focused in on the site testing  
14 priorities, because that seemed to be kind of the thing--the  
15 concerns that we saw in your letter kind of focused on how  
16 much information about the actual site will you really be  
17 able to get your hands on in the time frame before '98, and  
18 then again before 2001.

19           For the surface-based program, I think the strategy  
20 that we've used is to use the immediate next year or so to  
21 analyze and interpret the recently acquired data, as well as  
22 any existing data that had not been looked at adequately. I  
23 think that makes a lot of sense, in light of, you know,  
24 needing to kind of establish where are we, what is our  
25 understand right now?

1           Use existing holes for pneumatic testing. You know  
2 that we've had concerns about whether we need to make sure  
3 we're in there learning as much as we possibly can about  
4 existing conditions as the large excavation is created to  
5 determine if there's anything, you know, what additional  
6 information we can learn from that in the site as it's  
7 already been drilled and excavated. I think some people have  
8 questions about how much value this will have, but we clearly  
9 are going to try to do our best to test that question.

10           We have some other new strategically-placed new  
11 boreholes that I'll mention in a later slide before '97 that  
12 we'll have available to help us kind of expand our  
13 understanding, and I think before the technical site  
14 suitability evaluation.

15           One thing that I think is key is there's been an  
16 attempt to really expand the geophysics program in the near  
17 term to get a better overall kind of three-dimensional  
18 understanding that can be used as a part of that predictive  
19 modeling that I talked about before where, with some  
20 reflection, lines only run this year across the site, both  
21 north/south and east/west. We should then be able to use  
22 that to get a little bit better sense of whether, for  
23 example, there's any major structures that are buried that we  
24 can't see to the west side of the Ghost Dance Fault.

25           I know that's been a concern because, you know, if

1 you are not definitely going to be able to excavate over  
2 there prior to '98, it sure would be nice to have some good  
3 geophysics to look at, at least to give yourself a sense for  
4 whether there are any significant structures there.

5           The post-'97 program, just to kind of expand this  
6 out, then shifts over, for the surface program, at least, to  
7 really focus on support to ACD and Title 1, and I think to  
8 kind of fill in the three-dimensional geologic modeling  
9 stratigraphic modeling for the site.

10           Shift to the ESF for the minute. The pre-1998  
11 tests really focused on geology and hydrology, understanding  
12 in those, what, seven testing alcoves that I'll talk about in  
13 the next slide. 1997 to 2000, the program then develops the  
14 engineering parameters to get you ready for the construction  
15 authorization, and post-2000, as we've told you in our  
16 discussions of the program approach, we then focus on getting  
17 --completed the long duration coupled testing, and getting  
18 performance monitoring well underway so that we can feed that  
19 information back into the system and try to do some  
20 optimization.

21           Boy, it scares me when I look at one of these where  
22 I have all these yellow stickies on it. It probably means  
23 that I thought I was going to forget to say a bunch of  
24 important stuff, so I better read and see what these are, see  
25 if they're important.

1           All right. What I tried to do here, we had enough  
2 information for site suitability to really give you a little  
3 bit more detail, I thought, and so we tried to break it out  
4 and give you a table that I hope will give you a vision of  
5 where we will be in terms of additional information and  
6 understanding at the time we go into this key milestone,  
7 technical site suitability.

8           And so, in trying to tabulate that--and I know I've  
9 left some things out, and I want to apologize to the people  
10 in the audience, because I may have left things out that are  
11 equally important to what I have put up here, but let me just  
12 say that from the surface-based and laboratory side, it's  
13 clear that we will get some information from the C-well  
14 tracer complex when they get that rolling. It looks very  
15 likely that we'll have the money to drill several of the  
16 anomalies in Crater Flat to get a little bit more data on  
17 the--to fill in the rate curve for Bruce Crowe's volcanism  
18 studies.

19           The geologic drilling program--and this is, by all  
20 means, not set in concrete, but it looks like the plans for  
21 this year, at least, we know we'll drill one water table  
22 borehole into the area of the steep gradient. That will  
23 allow us--that, alone, with a reflection survey that will go  
24 up Yucca Wash and cut right across the steep gradient should  
25 start to give us an idea of what more we need to do. At

1 least, we'll do those, take a look at our understanding, see  
2 what we come up with, and then there's a possibility in the  
3 actual plans, there are four or five more that could be done,  
4 given funding, and given the need to do them.

5           Systematic boreholes, which are part of that  
6 systematic drilling program that we laid out in the site  
7 characterization plan to kind of systematically establish the  
8 stratigraphy and structure, there's a couple of those in the  
9 plans, pre-1997, and on the unsaturated boreholes, I think  
10 it's about four. Now, these are merged with, as much as we  
11 can, the drillholes that are put along the gradient for the  
12 south ramp, and so there's some consolidation, as I think  
13 you've heard some of our people talk about already, so we're  
14 trying to, as much as possible, economize on the total number  
15 of drillholes that we are going to invest in.

16           I mentioned the seismic reflection; very important,  
17 I think, from the standpoint of the near-surface structure,  
18 shallow, intermediate, lines across the block, probably three  
19 east/west and two north/south, and then the one I mentioned  
20 in Yucca Wash, and then, also, the long, deep seismic  
21 reflection line that runs up across Crater Flat should do a  
22 lot to kind of help us gain some confidence in the overall  
23 tectonic models, structural models for the area.

24           The trenches for tectonics and tectonic modeling  
25 and seismic hazards, pretty much completed in FY95, and, of

1 course, in the whole period of time that we're talking about,  
2 any new boreholes will do rock properties measurements, so  
3 even though we don't get a lot of new in situ  
4 thermomechanical data, we will still be getting that from any  
5 of the boreholes that are drilled.

6           Shift to the ESF for a minute. At each of the  
7 testing alcoves now, there are seven planned prior to--and  
8 maybe I should just go ahead and put that diagram up and  
9 point at the ones we're talking about. A little bit later in  
10 your package, there's a schematic that shows--numbers these  
11 testing alcoves that I'm talking about.

12           Radial boreholes and hydrochemistry tests in each  
13 of these seven testing alcoves, the idea here was to get as  
14 much information as we possibly could. This has now  
15 expanded. The radial borehole study plan was expanded to  
16 include the fault permeability testing, so that in each of  
17 these alcoves, we will get information about the chemistry  
18 and hydrologic properties to the extent that we can, and they  
19 are strategically placed in that they're now, instead of  
20 being just spaced along the ramp, they're spaced at where we  
21 expect the contact zones to be, so one would be at contact  
22 with the non-welded unit, one would be at the top of the  
23 Topopah Spring welded, so the placement of these is key to  
24 maximizing the amount of information we can get prior to  
25 1997.

1            Obviously, you know we're going to observe seeps in  
2 perched water, if we see any, through the baltic siting.  
3 It's somewhat frightening, depending on how much we see it,  
4 where it is, and how it behaves. That's going to be a very  
5 important part of the ESF facility.

6            The faults that we'll encounter prior to 1997, we  
7 will see the Bow Ridge, clearly, very early. The Drillhole  
8 Wash structure we encounter right here. The Sundance, in  
9 fact, I think on one diagram that's in your backup, it shows  
10 this testing Alcove 6 has been moved back so that it's  
11 probably going to be at about the point where the speculation  
12 is that the Sundance will cross, come across, so that we get  
13 a chance to actually look at the Sundance structure in that  
14 testing alcove, presuming that we find it there, and then, of  
15 course, the Ghost Dance.

16           Key to our characterization pre-'98 is getting two  
17 testing alcoves over to the Ghost Dance Fault vicinity, such  
18 that we can get a better understanding of how that behaves as  
19 a potential preferential flow path.

20           Any time we turn the TBM on, these last three areas  
21 of information will go forward in that we'll map--we'll do  
22 consolidated sampling and do our geochemistry, mineralogy,  
23 petrology on those samples, rock water interactions testing  
24 will be going on, as well as the measurement of  
25 thermal/mechanical properties, and construction monitoring.

1           So, there's a lot of information. The main thing  
2 in going through this in the detail that I have is to give  
3 you the impression that it looks like we will get a fairly  
4 extensive body of information into the program prior to the  
5 1997-98 time frame.

6           Now, moving on past technical site suitability to  
7 the 2000/2001, from here on, now, most of what is on these  
8 slides is material that you've already seen, in that it's the  
9 way we've really talked about prioritizing the program when  
10 we presented what was then the PPA to you; set up and do  
11 confirmatory hydrogeologic tests in the ESF, looking at the  
12 potential for some diffusion tests, get some interim results.  
13 We will have started some of the long-duration coupled  
14 testing, hopefully, in '96-'97, so we should be able to take  
15 a look in 2000 to see where we are and what kinds of  
16 information can be extracted.

17           We'll certainly attempt to bound the  
18 thermohydrologic response and we'll have to in order to make  
19 the case that we have to make in the construction  
20 authorization application; same thing with fracture matrix  
21 coupling.

22           One point I was going to make on this one that I  
23 will add, because I think it's of interest, one thing that's  
24 under consideration is that once we get over to this point,  
25 one important focus might be to put in an alcove over here--

1 or maybe it's in this alcove, I don't recall--but to start  
2 doing some plate-loading tests that would help us to get a  
3 little bit better handle on the stability over an extended  
4 retrievability period, and so there's some thought, you know,  
5 as to what specific testing, but we just aren't far enough  
6 along to really give you any more detail on that time period.

7           Okay. Now, I think from here on, there were in the  
8 backup I gave you--

9           DR. REITER: We don't have the backup.

10          DR. YOUNKER: Oh, did I skip one? Oh, you're right, I  
11 did. Sorry.

12           And then, going past 2001 to 2008, the priorities  
13 here basically confirming your previous information. This is  
14 your known, your performance confirmation period for your  
15 design, confirm your repository design, hydrogeologic tests  
16 in repository drifts, of course, continuing on with any of  
17 these long duration tests, but you're really only going to  
18 start feeling--beginning to get a sense of the repeatability  
19 of your results when you get out into time frames out into  
20 the mid-2005 to 2007.

21           Long-term confirmatory tests, and, hopefully, we'll  
22 be gaining increased confidence in the way we're modeling the  
23 fracture matrix coupling.

24           Okay. The rest of this is provided to you because  
25 I know you had real interest in the schedule, as it stands,

1 for ESF excavation, and this one is key to the schematic that  
2 I've shown here, and attempts to give you an understanding.  
3 Alcove 2 is the Bow Ridge Fault contact. The Alcove 3 is the  
4 Paintbrush non-welded contact. Alcove 4, the welded, and  
5 then 5, of course, the Drillhole Wash structure, and 6 and 7  
6 are the two Ghost Dance accesses.

7 DR. REITER: Jean, we don't have that backup in this  
8 handout given out today.

9 DR. YUNKER: Sorry. It was supposed to be there. I  
10 apologize. I'll make sure you have it. It hasn't changed  
11 much.

12 The other thing that's in there is simply a  
13 schematic. Is it in any of the materials the audience has?

14 (Negative response.)

15 DR. YUNKER: There's also a schematic that will be  
16 available--we'll get copies over here--of the surface-based  
17 program that kind of shows the location, not very well, I  
18 guess--it didn't come out on the view graph, at least--of  
19 some of the drillholes that I was talking about. Let's see,  
20 one of the ones, SD-12 is being completed right now, and one  
21 that will be important is this SD-7. There's one UZ-7 that  
22 will go into the right--to help understand the Ghost Dance  
23 Fault.

24 So, I think there's, I mean, if you look at the  
25 program from the surface-based and the ESF's standpoint, roll

1 it together, and try to get a picture of where we'll be in  
2 '97-'98, you know, granted, there may not be a lot of time,  
3 but I know your concern is whether we can digest it. You  
4 know, we're certainly going to get a chance to look at a lot  
5 of underground rock. We're going to get a chance to do a lot  
6 more sampling in drillholes, but I know, you know, the  
7 question of how you take all this information and digest it  
8 is clearly one that's on our mind.

9           I'm open to questions, and, as I said, I have  
10 people here who can help me, I hope.

11       DR. ALLEN: Okay. Thank you, Jean.

12           Are there questions from the Board?

13       DR. CORDING: Ed Cording.

14           It really does look like you're on the verge of  
15 access to a lot of really good quality information, and I  
16 think that there's--that the schedule is extremely tight, and  
17 the ability to achieve information by a certain date, or to  
18 analyze it, I think, is a real question, and it would seem to  
19 me that it's not a matter of whether one can get this  
20 information. It's just a matter of--it may be a little bit  
21 more time than what you have, you know, you're trying to meet  
22 a certain date, 1998, for example.

23           There'll be a lot of information coming in, and  
24 whether or not one makes a decision in 1998 or not on site  
25 suitability, there will certainly be a lot of more

1 information useful for site suitability, or whatever you want  
2 to describe it as, site suitability and licensing, and it's  
3 going to be important to integrate that into the overall  
4 picture. Isn't that, I mean, into the--it needs to be  
5 continued to be integrated, even immediately following, say,  
6 a 1998 decision.

7           One other thing that concerns me, and I didn't ask  
8 a question properly to you yet, but one of the things that  
9 does concern me is the ability to achieve the schedules. The  
10 schedule that's shown here is actually not a very high rate  
11 of advance-type of schedule, and--but even in the last month,  
12 a month or so ago, we were--the north ramp extension was  
13 being described as part of this pre-1998 schedule, and I  
14 think there was a discussion about stopping right after the  
15 Item 7 there, after the second Ghost Dance Fault crossing,  
16 and then not continuing out before 1998, so I was wondering  
17 if the reasoning for dropping the north ramp extension at  
18 this point, at least in this presentation here, what is the  
19 basis for that?

20       DR. YOUNKER: Well, I think the plan right now, or my  
21 understanding of it--and I will turn to someone else who can  
22 give a better answer in a minute--I believe the idea is that  
23 the north ramp extension is still in the five-year plan, but  
24 probably deferred until after '97-'98, and I think part of  
25 the problem is just attempting to squeeze the work that we'd

1 like to get done into the time that we have, and trying to  
2 prioritize. I believe that the--it was the smaller TBM, I  
3 guess, that was going to be purchased to do that, and I think  
4 that is not in the budget pre-'98 right now, so I think the  
5 idea is that when we do that, if we do the north ramp  
6 extension, we probably will go to drill and blast.

7 DR. BROCOUM: Let me make a comment, Jean.

8 Right now, the north ramp extension is like '98'99  
9 time frame in the five-year plan, and it's only there because  
10 of budget constraints, although you don't have the budget  
11 numbers in the five-year plan that we handed out today.

12 We are considering, though, the possibility of  
13 purchasing, rather than purchasing a TBM, purchasing a drift,  
14 and if it's deemed important, you know, based on all these  
15 conversations we're having, that it's more important to do  
16 the north ramp extension and continue on beyond Alcove 7,  
17 that will be something that will be considered.

18 As we tried to explain, this is all work in  
19 progress, and we haven't locked into the far out things yet.  
20 These are the various things we are considering, so--but  
21 just to get the five-year plan done had that schedule put in  
22 it because of budget constraints.

23 DR. CANTLON: Jean, could you give us some kind of a  
24 feeling for what the process has been or will be of providing  
25 the kind of feedback from TSPA back into this process of

1 prioritizing and planning? I presume that what you've laid  
2 out here is a first cut, and that, iteratively, it's going to  
3 mature and, essentially, Steve just described one of the  
4 possible changes.

5           To what extent is the TSPA process going to be  
6 involved in that changing of these priorities, and I presume  
7 the next iteration is '95. Is that going to be moved along  
8 and available early enough to feed into your priority  
9 setting?

10       DR. YOUNKER: We certainly hope so. I mean, we have  
11 established it such that now, whatever performance, whether--  
12 we have some that we call mini performance assessments.  
13 They're not an exercise from the top to the bottom of the  
14 pyramid, but they're really a look at one part of the system  
15 from a performance assessment modeling perspective, and I  
16 think our hope is, every one of those, if there's something  
17 to be gleaned that can be fed back in either to the site  
18 program, you know, in terms of priorities, to the design  
19 program, or to the overall priorities that need to be set  
20 programmatically, you know, it's our goal to always have that  
21 chapter at the end of the report.

22           Now, how well we do and how easy it is to connect  
23 and result in something that makes a fundamental change in  
24 the program is, of course, it's a very difficult question,  
25 but it's top on our list of why we're doing these interim

1 performance assessments.

2 DR. CANTLON: Well, to press you just a little bit in  
3 more detail on that, one of the things that the Board has  
4 essentially looked at over the years in working with DOE is  
5 the problem that you have of communicating between your  
6 various divisions, and is there some kind of management  
7 mechanism to bring that really into play in a timely way? Is  
8 that a priority?

9 DR. YOUNKER: It absolutely is a priority, and I guess  
10 the only--I tried to think of the ways to communicate. What  
11 you have now, I think, is a situation where the people in the  
12 site program who have the most direct interfaces, the  
13 performance assessment development, meaning they are people  
14 that are really working with the process modeling, and who  
15 tend to be, you know, toward the modeling end of site, are  
16 now identified and talking on a regular basis with the  
17 performance assessment team, so that you don't have--I think  
18 that the kind of separation that you were aware of in the  
19 past, I think, has--we've gone a long ways from that point,  
20 partly because, I think, we were looking at a lot of new  
21 people in the program--I'm giving a reason now for why there  
22 was broader separation--a lot of new people. I think we  
23 hadn't identified the people who needed to talk to each  
24 other.

25 Through the TSPAs that have now been done, I think

1 there's been an awful lot of good interaction, and I see it  
2 continuing with my people and performance assessment every  
3 day, so I have a lot of confidence it's happening. Whether  
4 we've formalized a management mechanism, I guess my gut  
5 feeling is the way you make it happen is you get the right  
6 technical people talking to each other and sharing  
7 information on a regular basis, and getting excited about  
8 their work and wanting to talk about it with the people who  
9 are going to use some of their work.

10 DR. CANTLON: Right, and who's responsible for making  
11 that happen?

12 DR. YOUNKER: I think we all are, all the managers in  
13 the program.

14 DR. CANTLON: When everybody's responsible, nobody's  
15 responsible.

16 DR. YOUNKER: No, I mean I manage performance assessment  
17 for the M&O, for example, under the Steve, and I'm  
18 responsible.

19 DR. BROCOUM: Performance assessment is in our group  
20 under suitability and licensing. We have an opening, by the  
21 way, that is posted right now for a team leader, performance  
22 assessment, and I'll just say that it's open through October  
23 18th, in case anybody's interested.

24 DR. YOUNKER: Should anyone be interested.

25 DR. BROCOUM: What my guidance is to the performance

1 assessment people is not--don't be--they were doing these  
2 biannual, every other year performance assessment is showing  
3 us how great the site is, in part, and my guidance was, that  
4 wasn't the goal. The goal was to have feedback back to the  
5 site characterization program, so Jean, for example,  
6 mentioned these mini TSPAs. We're looking for ways to have  
7 feedback timely so they can feed to the plan for the  
8 following year, and that's one of the issues on performance  
9 assessment, so we're trying very hard to make that happen.

10           Another thing we're doing is last, I guess it was  
11 last spring or last February, we had that one-week technical  
12 program review. I think it was more or less like a  
13 scientific meeting. We are planning a technical program  
14 review January 30th through February 4th, I think the dates  
15 are, where we're going to focus on the needs in the data--  
16 these data--technical data packages for suitability, and what  
17 those needs are, and how the principal investigators are  
18 feeding into those needs, and that will help bring all the  
19 people together about those data packages, as opposed to just  
20 a scientific meeting when you have a whole bunch of people  
21 telling you what great work they're doing.

22           So, we're trying to use these kinds of methods to  
23 bring the right people together.

24       DR. ALLEN: We're getting farther and farther behind,  
25 but Don Langmuir had a question.

1 DR. LANGMUIR: I've forgotten which one it was, Jean,  
2 but something that came up that's very specific in here, a  
3 question, was your--under the summary of key uncertainties on  
4 slow transport through the geosphere, you titillated me with  
5 young dates for some deep unsaturated zone groundwater, and I  
6 have a kind of a preliminary answer to that from a  
7 conversation in the hallway, in which I learned that some of  
8 the Chlorine-36 dating is now suggesting ages as young as a  
9 few--10,000, maybe 20,000 years are coming out of this, some  
10 rather young dates for water down to the middle of the  
11 unsaturated zone.

12 DR. YUNKER: Right; yes. Yeah, that's the information,  
13 I think at least some of it is that I've seen in the draft  
14 presentation that John Stuckless will be giving, and I think  
15 he's beginning to see a fairly coherent pattern when he's  
16 taken all the information and put it together, so it's going  
17 to give us an additional understanding, I think, of the total  
18 groundwater, unsaturated and saturated zone hydrologic  
19 systems.

20 DR. LANGMUIR: Is it beginning to make you more nervous  
21 about travel times through the unsat zone? They're getting  
22 shorter and shorter all the time.

23 DR. YUNKER: I don't--I think I'm nervous if I don't  
24 understand them, let me put it that way. I think the more  
25 understanding we have, the better off we are.

1 DR. ALLEN: I think all of us have questions as to why  
2 certain things are or are not included on your list, but we  
3 could sit here all afternoon and go at this, and I think we'd  
4 better get on with it, but, Dennis, do you have a quick  
5 question of a general nature?

6 DR. PRICE: I can do this real quick, and that is: What  
7 is the question you're interested in answering regarding the  
8 steep gradient? Is it potential pathways to the repository?

9 DR. YOUNKER: No. The steep gradient, I think the whole  
10 question there is just, I think our UZ hydrology peer review,  
11 as well as the ESSE peer review both said to us, if you don't  
12 have a good credible explanation of it, or at least some  
13 understanding of it, your overall understanding of the  
14 hydrologic system will be questioned, so it's really just a  
15 good, you know, a good enough explanation that we can make it  
16 a part of the overall hydrologic system in our presentations.

17 Because, right now, we kind of tend to not quite  
18 know how to explain it. We have a couple of different  
19 options. Hypotheses have been presented, and I think we  
20 probably are not too concerned. Most of us are not too  
21 concerned about its performance implications, but it causes  
22 you to feel a little weak in your understanding of the  
23 hydrologic system.

24 DR. ALLEN: Unfortunately, I know there are further  
25 questions. I think we've just got to move on to be fair to

1 the speakers, and also, during the session this afternoon,  
2 there'll be some occasion on this, so, Pat, will you permit  
3 me?

4           The next speaker is J. Van Miegroet from Belgium,  
5 who will talk about the concept or role of engineered natural  
6 barriers in that program.

7           DR. VAN MIEGROET: I am going to provide you a  
8 refreshing intermezzo, if you please, from the meeting.  
9 Somebody from your staff was a little bit fearing that people  
10 in the audience may not even know where Belgium is, and just  
11 asked me to put into some perspective the situation in the  
12 country where I am coming from.

13           So, this is Belgium. Belgium is located in western  
14 Europe, about the center of the triangle between Paris,  
15 London, and Bonn, so we are really centrally-located, and  
16 Belgium is a very small country, 30,000 square kilometers,  
17 heavily populated, 10 million inhabitants, best known for its  
18 capital, Brussels, which is also the capital of the European  
19 Union.

20           So, the nuclear facilities are only civilian  
21 facilities in Belgium. We don't have a military nuclear  
22 program. We have been living under the umbrella provided by  
23 the United States. These nuclear facilities belong most to  
24 the nuclear fuel cycle; namely, seven powerplants, with a  
25 total power of 5,500 megawatt electrical, four in the

1 northern part of the country--you can see that here, which is  
2 what is called Doel, three in the southern part of the  
3 country, which is called Tihange.

4           There are also two fuel fabrication facilities at  
5 Mol-Dessel, one for uranium fuel, one for plutonium, which  
6 means, under the present condition, for MOX fuel. There was  
7 even, sometime ago, a pilot reprocessing plant which was  
8 called EUROCHEMIC, also located in Mol-Dessel; located, also  
9 located in Mol-Dessel.

10           The nuclear wastes arising from those facilities  
11 are of the three classical types, of course; short-lived, low  
12 activity, 150,000 cubic meters for the period up to 2050,  
13 including decommissioning waste; Type B, long-lived low and  
14 medium activity, 25,000 cubic meters, same period; and then  
15 Type C, heat-emitting long-lived high activity, 5,000 cubic  
16 meters. So, there is, indeed, no comparison with your  
17 nuclear waste program.

18           Before starting my presentation on the underground  
19 disposal, I think I better indicate what the project timing  
20 is, because this project timing brings with it a lot of  
21 differences with this schedule business that your program is  
22 heavily connected with.

23           As you can see, the first time we plan to install  
24 the heat-emitting waste in the underground facility is 2050,  
25 in the year 2050. The reason for that is that the geologic

1 medium we are planning to use is not fit to receive heavily  
2 heat-emitting waste, so we have to let it cool down for at  
3 least 50 years somewhere in the surface, and we are actually  
4 serious about it in the sense that we have been building a  
5 special facility at Mol-Dessel to store during those 50-plus  
6 years the so-called canisters, vitrified canisters coming  
7 back from the reprocessing installation in France.

8           So, this building is being built, and will be  
9 brought into operation sometime during next year, and the  
10 waste will just be left there for further cool down, so that  
11 explains the fairly long-range planning that I have been  
12 showing.

13           Now, how do we go with this geological disposal?  
14 First of all, we did select, a fairly long time ago, 15 years  
15 ago, should I say, we did select the geological medium into  
16 which we plan to install those high-level waste heat-emitting  
17 wastes. It was based on the following rationale:

18           The European Catalogue of geological formations  
19 having suitable characteristics for the disposal of  
20 solidified HLW and/or long-lived radioactive waste identified  
21 in Belgium five formations that could be suitable for such an  
22 undertaking; three hardened rocks, and two plastic rocks.  
23 The two plastic rocks were Ypresian and Boom clays. Ypresian  
24 and Boom are the name, actually, are the name of cities in  
25 Belgium where these two clay layers are actually coming to

1 the surface.

2           The next step of the rationale was to select one of  
3 those five potential rocks. There came along a circumstance  
4 or condition; namely, that the Boom clay was present in the  
5 underground of the Mol Research Center at adequate depth,  
6 with a number of attractive features unequaled by the other  
7 media. Those attractive features were, essentially, low  
8 permeability, homogeneity, self-healing properties, and low  
9 migration velocities for most nuclides.

10           Going one step further, performance, preliminary  
11 performance analyses were carried out in 1986 to '88 under  
12 the name of the PAGIS action, with realistic datas on a  
13 number of major scenarios, and these come from the medium  
14 potentialities. They also quantified the critical importance  
15 of several clay properties, mostly the effective thickness of  
16 the layer, the diffusion coefficient, and the retardation  
17 factor for dose limitation, which is, of course, the ultimate  
18 goal of the whole exercise.

19           These performance analyses also identified--and  
20 this is extremely important--that the very efficient  
21 confinement provided by the clay layer masks the  
22 contributions of the engineered barriers in the systems  
23 performance evaluation.

24           Starting from there, we went out to start defining  
25 the most important facility conceptual design features. The

1 PAGIS findings indicated that it--or recommended to maximize  
2 the thickness of the clay barrier available for nuclide  
3 retardation. It is keep the mined repository as flat as  
4 possible, and, two, minimize the amount and severity of the  
5 perturbations imposed to the natural barrier while  
6 constructing and operating the repository.

7           These two major principles have led to a number of  
8 design criteria. One, the waste will be disposed of in  
9 horizontal galleries. Two, the disposal gallery diameter  
10 will be kept at a minimum. Three, the heat-emitting waste,  
11 vitrified canister and spent fuel, will only be disposed of  
12 several decades after fuel unloading from the reactor, when  
13 residual heat generation will be down to a small percentage  
14 of its initial value.

15           Four, minimizing the volume of oxydable materials  
16 associated with the waste will restrict gas production and  
17 pressure buildup to levels acceptable for the clay layer.  
18 Five, the backfill that is needed to bring the gallery to  
19 their more or less initial condition, will primarily aim at  
20 reducing the disruptions to the clay layer by minimizing the  
21 residual void percentage inside the galleries, developing a  
22 high degree of chemical compatibility with the geological  
23 environment, providing counter-pressure to the gallery wall,  
24 thus significantly postponing lining collapse and preventing  
25 water vaporization in the backfill.

1           Moreover, and this is going on at the moment,  
2 additional efforts are being made to develop tunneling  
3 techniques that would limit the disposal gallery diameter to  
4 little more than the waste canister diameter, reducing even  
5 more the geomechanical and hydraulic disruption of the clay  
6 layer.

7           So, this is essentially the clay layer as it  
8 stands, or lies at Mol in the underground laboratory that has  
9 been built there. The distance between the above-ground and  
10 the mid-plane of the clay layer is about 230 meters above the  
11 clay and under the clay, which is about 90 meter thick, you  
12 get a sandy aquifer on both sides.

13           The repository itself should artistically look like  
14 this; heat-emitting waste being separated from the rest of  
15 the wastes that need to be disposed of, also, in the  
16 geological medium, and then the gallery for heat generating  
17 waste would look like this, with the heat generating waste in  
18 the middle of the gallery, inside a so-called protecting  
19 shroud, which is a thin, but thin means 2 centimeters, about,  
20 a thin pipe, which would host the canister and which would  
21 also be made to host the fuels in assembly for the case where  
22 fuels of assembly, unprocessed fuels in assembly would have  
23 to be disposed of.

24           So, you can see that to install that thing in the  
25 medium, in the clay layer, we have to excavate a fairly large

1 gallery, 2 meter by 2 meter gallery, that is then supported  
2 by a concrete wall, and then we have to backfill the  
3 distance, the underlapsed space between the center shroud and  
4 this concrete wall.

5           So, the idea that I have been mentioning a few  
6 minutes ago, additional efforts are being made to develop  
7 tunneling techniques that would limit the disposal gallery  
8 diameter to little more than the waste canister diameter,  
9 refers to this, where we would actually excavate, tunnel a  
10 gallery which would be only a few centimeters higher in  
11 diameter than the needed diameter of the central tube, which  
12 would even more reduce the perturbation to the geological  
13 medium.

14           Beyond the criteria that has been developed to  
15 satisfy the essential findings of the PAGIS evaluation or  
16 performance analysis; namely, keep the mine repository as  
17 flat as possible, and minimize the amount and severity of the  
18 perturbations.

19           Several other important criteria have also been  
20 developed. Distributing the global repository into at least  
21 two areas sheltering, respectively, the heat-producing and  
22 the non-heat-producing waste; completing the gallery network,  
23 including installation of the central shroud and backfill,  
24 before initiating the waste installation phase, thus, totally  
25 separating the active and non-active operational phases;

1 maximizing the thermal conductivity of the backfill; and  
2 providing the disposed waste with some degree of  
3 retrievability.

4           The R&D programs have been developed to meet those  
5 requirements and to make and to provide to the program the  
6 needed information. This R&D program is focusing on, one,  
7 the long-term safety demonstration; and, two, the technical  
8 feasibility demonstration. We feel that the two aspects must  
9 proceed hand-in-hand, because you cannot concentrate yourself  
10 forever on demonstrating the safety of the system without  
11 getting a sufficiently clear idea of what the system will  
12 look like even in some of its technical, and even  
13 technological details. So, the two aspects are being pushed  
14 simultaneously.

15           The first of them is this long-term safety  
16 demonstration. One, quantification of the clay material  
17 properties relevant to the nuclides migration process; small-  
18 scale permeability, diffusion, retention, and so on. Detail  
19 mapping, using seismic techniques and confirmation boreholes  
20 of the local geology in search of the inhomogeneities that  
21 might affect the global permeability of the clay. I'm not  
22 talking here of the small-scale permeability, but of the  
23 global permeability at the scale of the global layer.

24           Corrosion experiments, investigation, mapping, and  
25 modeling of the regional hydrogeology, assessment of gas

1 production, pressure buildup, and pressure release  
2 mechanisms, development and demonstration of backfill  
3 additives for trapping hard-to-catch nuclides, identification  
4 and development of FEPs and scenarios for performance  
5 analysis, development and calibration of the mathematical  
6 models used for deterministic and stochastic performance  
7 analyses, and, finally, exploration of natural analogues  
8 potentialities in a clay environment.

9           All this is going on. There are contracts, some of  
10 them back several years ago to really explore and generate  
11 the data that are needed for the further performance  
12 analysis, and then from the second aspect, technical  
13 feasibility demonstration.

14           As I say in the paper that you have in front of  
15 you, the actual repository is not to be constructed before  
16 several decades. It is, thus, likely to take advantage of  
17 presently unheard of technological developments. However,  
18 demonstrating the technical feasibility with today techniques  
19 of several key aspects of its construction and operation,  
20 particularly those dealing with unusual equipment or unusual  
21 uses of existing equipment, is a necessary step when  
22 attempting to build now a realistic and convincing safety  
23 case.

24           Most important those key aspects is selection,  
25 fabrication, testing, installation procedure, mathematical

1 modeling, and so on, of the pre-compacted bentonite-based  
2 material that will backfill the annular region; design,  
3 construction and testing of a prototype machine that will  
4 transport, handle, and emplace the waste canisters and spent  
5 fuel subassemblies at their final disposal location; design,  
6 construction, and testing of a special micro-tunneling  
7 machine that would essentially limit the tunnel excavation to  
8 the diameter of the waste-hosting shroud.

9           So, this is our program of research and  
10 development. There are, of course, some concerns which are  
11 remaining about some program that we feel we have identified  
12 and for which, at the moment, we still don't have any  
13 solution of any demonstrated, at least, solution.

14           The first of them is the inadequate retention  
15 performance of the clay barrier for some nuclides; most  
16 notably, Iodine-129; large scale permeability of the clay  
17 layer. The seismic experiments that I have been mentioning  
18 have not been providing, up to now, the answer that we were  
19 looking for.

20           Backfilling and obturation, with the needed  
21 effectiveness of the shafts and main galleries in the post-  
22 operational phase; buildup and release of gas pressure inside  
23 the geological medium; and potentially harmful consequences  
24 for the repository of the next major glaciation period.

25           We fully realize that the depths of the boom clay

1 in the northern part of Belgium is on the low side, when  
2 taking into account the potential problems; erosion, for  
3 example, deepening of valleys that may derive, and others  
4 that may derive from the glaciation period that is predicted  
5 for the next 50,000 or 60,000 years.

6           That's it. That's about the way the Belgian  
7 program is being conducted, is being developed, is being  
8 conducted, and the time schedule into which the whole picture  
9 is fitting, so I am open to any questions that you may have.

10       DR. ALLEN: Thank you.

11           Are there questions from the Board?

12       DR. CANTLON: Cantlon; Board.

13           I understand that you have now expanded your  
14 program to include disposal of spent fuel, as opposed to  
15 vitrified reprocessing waste, and how do you visualize the  
16 container? Here you have void space, and so on. Are you  
17 planning a filler?

18       DR. VAN MIEGROET: At the moment, but these things are  
19 rather preliminary. We plan to install each individual  
20 assembly as it is, without any other reprocessing or pre-  
21 reprocessing of any kind into a cylindrical box, filling the  
22 void inside the cylindrical box with sand, essentially, and  
23 then that will be--that would be the package that then comes  
24 forward and we would dispose in the repository.

25       DR. LANGMUIR: You don't have the kind of regulatory

1 guidelines assigned to the Belgian program that we have here,  
2 obviously. Is the concept of site suitability even something  
3 you think about? Is that a concept that you've had to deal  
4 with in your program, at least among yourselves?

5 DR. VAN MIEGROET: The concept of what?

6 DR. LANGMUIR: Is the site suitable or not? Is that an  
7 issue that you've raised?

8 DR. VAN MIEGROET: Not really. We are, indeed,  
9 extremely lucky not to have the type of regulation that you  
10 are submitted to. However, and I did not mention that when I  
11 was indicating the planning of the whole thing, however,  
12 besides building the facility or installing the heat-emitting  
13 waste in the year 2050, we have some intermediate deadlines,  
14 which means that every ten years, our government is  
15 requesting us to supply to them, every ten years, a state of  
16 the development of the repository, or of the works that would  
17 ultimately lead to the repository.

18 We have been doing that for the first time in 1987,  
19 and we will, thus, do it again in three years from now, two,  
20 three years from now, and on these occasions, we have to  
21 submit a report, and we did so in '87. We have to submit a  
22 report that is being scrutinized by a so-called scientific  
23 commission that is being gathered for that purpose by the  
24 government authorities, and, thus, inside that body, there  
25 are quite a lot of discussion about quite a lot of aspects of

1 the design we are presenting, including, of course, the site  
2 suitability aspect of the thing.

3           We have been given, in '87, a green light to  
4 proceed along the line of the Boom clay layer with a small  
5 restriction; namely, that we should not completely forget to  
6 investigate, or do at a very much minor level, investigate  
7 the other clay layer that I have been mentioning in my paper;  
8 namely, the Ypresian layer, which is--which has some  
9 characteristics less favorable than the Boom clay layer, the  
10 Boom clay, but which has the interesting characteristic, to  
11 the contrary, to be deeper in the ground in some places of  
12 Belgium.

13           So, we are doing that, and we plan to present the  
14 results of that preliminary investigation aspect in the next  
15 report, which is in '97.

16       DR. BARNARD: Bill Barnard; Board staff.

17           You mentioned for disposing of the heat-emitting  
18 waste, that you're going to be waiting several decades to  
19 allow for the fuel to cool off. How long is several decades?

20       DR. VAN MIEGROET: Several decades means, well, I say  
21 that more or less, when you see the planning, the time  
22 schedule, you can see that we anticipate to start in storing  
23 the so-called heat-emitting waste in the year 2050, which  
24 means that for the first canisters that we have available, it  
25 will be about six decades at that time.

1 DR. REITER: Leon Reiter; Board staff.

2 Mr. Van Miegroet, one of the primary reasons we  
3 invited you to make a presentation is because Belgium has  
4 such a large reliance on natural barriers, and we can follow  
5 in the round table on this.

6 I wonder if you could tell us, to what extent is  
7 this reliance on natural barriers dictated by the fact that  
8 you're in clay, and to what extent is this a general  
9 philosophical approach in Belgium? For instance, you said  
10 you also looked at some hard rocks, some shale, but you've  
11 decided to go with the clay instead of the shale.

12 Was part of that due to the fact that you could  
13 build--have a stronger natural barrier in clay?

14 DR. VAN MIEGROET: I don't think I would say so. The  
15 selection between the plastic clay and the non-plastic  
16 material, shale, was made at a very early stage, and it was,  
17 as I said, rather circumstantial, because one of the two  
18 plastic clay layers was actually located--happened to be  
19 located under the nuclear research center at Mol.

20 It turns out that the findings that have been made  
21 since then have been, well, confirming the hopes that the  
22 people who made that selection, or elected to proceed, so  
23 have been confirming the potentialities of that layer, and,  
24 thus, having made that selection, and coming to the  
25 conclusion that because of the self-healing properties, or,

1 essentially, because of the migration properties, the  
2 retention properties, the clay was so good, to the extent  
3 that I see it in this PAGIS report, it does not need to be  
4 completed, should I say, by other barriers, artificial  
5 barriers, except that it needs to be protected.

6           In other words, the artificial barriers all do  
7 play, in our concept, very little role in the total  
8 protection of the people, of the population, they are  
9 extremely important for, in, as I said, minimizing the  
10 perturbation of the main, of the natural barrier, actually.

11         DR. ALLEN: Thank you very much. I think we simply must  
12 move on, but it was very good of you, Dr. Van Miegroet, to  
13 visit with us. Thank you.

14           The final speaker before the round table is Edward  
15 Patera of Los Alamos, who will be talking about crystalline  
16 rock repositories and the role of engineered barriers,  
17 particularly, there; I gather, particularly the Swedish  
18 experience.

19         DR. PATERA: Thank you very much. My name is Ned  
20 Patera, and I'm presently with Los Alamos National  
21 Laboratory, but I was asked to come and present to you the  
22 crystalline rock repository concepts and the role of natural  
23 and engineered barriers based on my experience at the OECD's  
24 Nuclear Energy Agency, where I was for the last two and a  
25 half years. So, we'll get going here.

1           These are the countries that are considering  
2 crystalline rock as a host repository medium for disposal of  
3 high-level radioactive waste. Canada, Finland, and Sweden  
4 are the ones that are looking just solely at crystalline  
5 rock. France, Japan, Spain, and Switzerland are also  
6 considering other geologic media, such as clay or salt, and  
7 perhaps I should talk in terms of argillaceous material  
8 instead of the clay, because we've just heard of the  
9 distinction between some of the plastic clays and some of the  
10 hard clays.

11           Now, some of the advantages and the disadvantage of  
12 using crystalline rock for a host medium for disposal, one,  
13 the hydrology is usually pretty favorable, with the low  
14 porosity and low hydraulic conductivity. The chemistry,  
15 normally, at repository-type depths is reducing conditions;  
16 that is, that the oxidation potentials are very, very low,  
17 which help out in the solubility, and also the corrosion  
18 resistance of any canister. There's also the sorptive  
19 potential of the mineralogy, both the primary mineralogy of  
20 the rock itself, and also within the fracture walls.

21           This should be geomechanical, not geochemical, but  
22 crystalline rock, as we all know, is quite solid and is  
23 easily mined, and also, since these are not sedimentary units  
24 or laid down in, such as the Yucca Mountain, we're not  
25 limited to a two-dimensional repository design. It can be

1 three-dimensional, and this picture illustrates--this is from  
2 the NAGRA concept--what a repository layout could look like  
3 in a crystalline environment.

4           You can see--it doesn't really show up too well,  
5 but they have used a multi-tiered level of galleries within  
6 the system. Now, one of the--also, one of the disadvantages  
7 is this occurrence of large-scale fractures that can act as  
8 conditions for radionuclide migration. In all the concepts  
9 that I know of, what they do is the layout of the galleries  
10 themselves are in the solid blocks of rock, and they stay  
11 away from any of these large-scale fracture features.

12           The last advantage that I'd like to mention about  
13 crystalline rock is one about human actions, and I mean  
14 future human actions, or the human intrusion problem, and,  
15 usually, you can find areas of crystalline rock that  
16 basically are rather boring, geologically and economically,  
17 so that you can reduce the potential for any sort of resource  
18 potential that future societies may be going after.

19           Now, at this point, I'd like to focus in on the  
20 Swedish program, and just tell you a little bit about it, and  
21 what they're doing, and, also, as you've all heard, I'm sure,  
22 that they are using a copper canister as their primary  
23 barrier for containment and isolation of their waste, but  
24 we'll talk a little bit more about this later.

25           First, the law. And this, in Sweden, as in other

1 countries, the law says that whoever operates nuclear  
2 powerplants is--has the responsibility of disposing of the  
3 wastes in a safe manner, and this is fundamentally different  
4 from the United States and it, I think, makes a big  
5 difference in terms of the way the Swedish system has been  
6 organized.

7           There are four nuclear power utilities within  
8 Sweden. They formed a consortium, first of all, to supply  
9 their nuclear fuel to their powerplants. When the law, the  
10 stipulation law in 1977 came out in Sweden, that directed  
11 them to begin looking at radioactive waste disposal, the  
12 utilities passed this consortium that provided the nuclear  
13 fuel to the reactors, with the project of looking at how to  
14 dispose of spent nuclear fuel within Sweden.

15           This was the KBS project. That project was  
16 completed in 1983, with a report called KBS-III. This came  
17 up with the reference Swedish system for the disposal of  
18 high-level waste and spent nuclear fuel, and so I wanted to  
19 show you a little bit about the SKB system.

20           What we have here is just pictures of what the  
21 whole system looks like within Sweden, up to the geologic  
22 disposal. First, they had the transportation system.  
23 There's a specially-designed ship which transports the fuel  
24 to the reactors by sea, and then it takes all the waste back  
25 by sea to their respective places. The low and intermediate

1 level waste goes to the SFR, which sit there, and this is a  
2 mined geologic repository in crystalline rock underneath the  
3 Baltic, but at a very shallow depth. It's 50 meters below  
4 the sea.

5           The spent nuclear fuel arrives at the CLAB facility  
6 up in the upper right-hand corner, and this is then stored  
7 there, and this--it's wet pool storage, and this has been in  
8 operation since 1985. This is the facility that Steve Kraft  
9 was talking about that provides them with a time buffer, and  
10 the capacity of this facility right now can handle half of  
11 the nuclear fuel that they expect to have. They have plans  
12 to expand it so it can hold all of the spent nuclear fuel  
13 within Sweden.

14           This is where the fuel will remain until it is  
15 finally disposed of, and it will be at this place where it  
16 will sit and cool for decades; in this case, about 40 to 50  
17 years. Again, this is the Swedish system; where the waste  
18 comes from, where it goes to, and then in the final disposal  
19 concept, into crystalline rock.

20           This outlines what SKB isolation strategy is. The  
21 multiple barriers concept is basically imbedded in the slide.  
22 The stable host environment's provided by the crystalline  
23 rock. By stable, I mean tectonically stable, and also stable  
24 from any other types of perturbations that naturally occur.

25           They use a stable barrier material, such as

1 naturally-occurring clays and copper for the engineered  
2 barrier system. They want stable, ambient conditions. This  
3 is basically that they want cool conditions within their  
4 repository. This is why they let the spent fuel cool at the  
5 CLAB facility. I think their reference design temperature is  
6 a maximum of 80 degrees C, and, also, they want stable  
7 chemical conditions within the repository system, and, again,  
8 they are using the multiple barrier system to protect against  
9 any unforeseen events, material defects, or design defects.

10           These are the basic components of the disposal  
11 system, starting with the spent fuel. This is then emplaced  
12 in a canister, and this is the heart of the disposal concept  
13 to contain and isolate all the radionuclides. Originally,  
14 the KBS-III project had a thick-walled copper canister. They  
15 now are looking at a composite canister, with an inner liner  
16 of steel that provides strength, and then the copper outer  
17 can, which provides a corrosion barrier.

18           This is then embedded in highly-compacted bentonite  
19 clay, and this bentonite clay is there to protect the copper  
20 canister, and also, to limit the egress of any radionuclides  
21 later on. All this is placed in crystalline bedrock at  
22 approximately 500 meters depth.

23           Their safety assessment, they look at a variety of  
24 scenarios to assess what might happen outside the expected  
25 conditions, and this is just sort of a partial picture of

1 some of the things that they are looking at; changes in the  
2 climate, either warmer conditions, or Ice Age conditions.  
3 They realize that they are going to have a recurrence of the  
4 Ice Age, and what are the effects on the groundwater, and,  
5 thus, any changes in those geologic conditions, how would it  
6 affect the life of the canister, and any migration of  
7 radionuclides.

8           Also, under other unforeseen events, I think we  
9 would look at the human intrusion aspects. I know that they  
10 have done analyses with that, looking at those kinds of  
11 scenarios.

12           What I'd like to do is just describe for you what  
13 was in the KBS-III Report with regards to what the principal  
14 functions of each of these barriers are; in other words, what  
15 were the roles of the natural barrier, what's the role of  
16 some of the engineered barriers.

17           The final repository system as a whole has two  
18 principal functions. One is a containment period, and it  
19 just specifies for a long time, and this is what they  
20 consider the first phase. After the first phase, the system  
21 is then to provide for dilution of radionuclides by slow  
22 release and dispersal through the geosphere.

23           The canister itself has one principal function;  
24 contain the spent fuel for a long period of time, and when we  
25 consider what a long period of time is, the SKB right now is

1 saying that they can pretty much assure the integrity of a  
2 copper canister for over one million years, and this, then,  
3 prevents any release of radionuclides into the groundwater.

4           This should say the buffer barrier system, and this  
5 is the highly-compacted bentonite clay, and its principal  
6 functions are to provide a mechanical and chemical zone of  
7 protection around the canister. Once the Swedes had picked  
8 the copper as their choice, then their program became very  
9 focused. It all became focused on protecting the canister,  
10 and this is the primary function of this buffer. It's also  
11 to limit the inward transport of any corrosive substances to  
12 the canister, and then, finally, in the event of a canister  
13 failure, this buffer is to provide for the slow migration of  
14 radionuclides that would be leached.

15           And then, finally, the geologic barrier, the  
16 essential properties that they are looking for within a  
17 geologic site are the low hydraulic conductivity to limit the  
18 total flux of water past the repository system. They're  
19 looking for sorptive properties of the fracture surfaces, so  
20 that retardation will occur in any migration of any leached  
21 radionuclides in the event of a canister breach; and, also,  
22 they're looking for the diffusion of dissolved radionuclides  
23 into the microfissures within the rock. This is commonly  
24 called the matrix diffusion, for a lot of those that know  
25 about that.

1           So, those are the principal functions that they see  
2 for not only the engineered system, but also the natural  
3 system. Now, I would like to turn attention to the copper  
4 canister a little bit, and discuss a little bit what makes  
5 this so great. Why can they guarantee, or assure us of a  
6 million years' worth of containment?

7           This is basically rooted in the--I'll start with  
8 this Eh/pH diagram, and you'll notice that in the system of  
9 copper and water, under certain groundwater conditions,  
10 copper metal is a stable solid phase right here. Now, the  
11 expected repository conditions, and the one that they used in  
12 their latest performance assessment, which was SKB-I, they  
13 used a generic research site that they have been looking at,  
14 and there the expected conditions, or, actually the measured  
15 conditions is an Eh of about 7, and an Eh of between -200  
16 millivolts and -300 millivolts, so that puts you right in  
17 this field here.

18           Now, as I said, this is where copper is  
19 thermodynamically stable and would sit there as happy as can  
20 be forever. However, the fly in the ointment is that the  
21 groundwater is not pure water, and so we need to look at a  
22 more complex Eh/pH diagram which shows the system of copper,  
23 carbon as carbonate in the groundwater, sulfur and sulfide  
24 and water, and in this case, we can see that the repository  
25 conditions, the stable, solid phases would be copper sulfide.

1           So, the question becomes, do we have sulfide in the  
2 groundwater, and, if so, how much corrosion would we expect  
3 from that amount of sulfur? Now, these Eh/pH diagrams are  
4 drawn based on a slice of concentration. In other words, if  
5 we reduce the amount of sulfur within this system--and I'm  
6 talking sulfide, not sulfate at this point--then the  
7 stability field of copper would begin to grow until you  
8 remove all the sulfur and you're back to this more pure  
9 system where copper metal is stable.

10           So, again, by using these fundamentals principles  
11 that are in elementary textbooks, the Swedes have been able  
12 to focus their whole program, not only geologic program, but  
13 their laboratory testing, on these fundamental issues;  
14 basically, protect the copper canister, and look for a site  
15 where the sulfur content is quite low.

16           Normally, in groundwaters you don't find very much  
17 sulfide. You do find sulfate, and a lot of debate has gone  
18 on about can you reduce the sulfate to sulfide, and then have  
19 copper corrosion. So, this is how they target their  
20 laboratory work.

21           In the site characterization field, what they do is  
22 they have developed techniques for measuring in situ Eh.  
23 This is very important to them. They need to find places  
24 where they can count on the reducing environment, and so they  
25 have developed special probes for that.

1           Now, the methods to prove the corrosion resistance  
2 for copper, for the copper canister, as I mentioned,  
3 laboratory corrosion tests, but these can only be conducted  
4 for maybe up to a few years. The extrapolation, then, of any  
5 of that information out to a million years would be  
6 propagation of the uncertainty within the experiments, would  
7 be almost meaningless.

8           So, what the SKB did is they embarked upon a  
9 program of looking at other ways of getting a handle on the  
10 corrosion rates of copper, and they've done several things.  
11 One is to measure the corrosion from modern applications of  
12 copper, and here they've looked at copper electrodes that  
13 have been implanted in the ground. These are basically in  
14 oxidizing conditions, but they've looked at this anyway, and  
15 determined corrosion rates for these. The span of time is on  
16 the order of maybe 100 years for this. Again, given the  
17 uncertainties in the measurements, and not knowing exactly  
18 the initial conditions, the propagation of uncertainties will  
19 be pretty tremendous out in a million years.

20           So, they go on and they look at the corrosion of  
21 historic and prehistoric copper-based artifacts, and these  
22 can give you information on the order of 100 to, say, 5,000  
23 years. There are copper artifacts, and, also, bronze  
24 artifacts that have been around for a long time, and they can  
25 actually get a very--not a very, but a fairly good estimate

1 of the general corrosion rates based on the markings that  
2 have been initiated on these artifacts.

3           And then, lastly, is a study of naturally-occurring  
4 native copper ore deposits, and these are known worldwide,  
5 and they have been known to be in equilibrium with host rock  
6 settings for literally millions of years, and it's through  
7 this kind of coordinated study, on looking at the corrosion  
8 of copper, that they have been able to take credit for about  
9 a million years' worth of containment, with a high degree of  
10 confidence in their canister.

11           I just wanted to show you, this is one of the  
12 examples of a natural analog that SKB has looked at. This is  
13 a copper cannon that has been imbedded in the sea floor since  
14 the 17th century, so this is one of these historic artifacts  
15 that I was mentioning, and this is a very good demonstration  
16 for the public. They can put their hands on it. They can  
17 see this. They understand it, and it helps build confidence  
18 within the public.

19           So, the conclusions about copper as a chemistry  
20 material is that the long-lived and robust engineered  
21 barriers, especially copper, provide a high degree of  
22 confidence that radionuclides can be contained within a  
23 geologic disposal system, and this high degree of confidence  
24 can be shared by not only scientists, but engineers,  
25 politicians, and the public at large.

1           I have a second part of the talk that I was asked  
2 to give at this point, and this is basically a quick summary  
3 of what some of the other national programs are doing within  
4 the OECD. I can go through it very quickly, in the order of  
5 saving some time. As a matter of fact, there is Belgium, but  
6 we've already heard from our colleague here, and he gave us a  
7 very nice presentation on that, so we'll move on quickly.

8           Canada. Canada is going to dispose of CANDU spent  
9 fuel. They're looking at a crystalline rock environment.  
10 Their canister materials are titanium alloy as their primary  
11 one, with copper as a backup. The buffer material is a  
12 bentonite and sand mixture, and, right now, the AECL has  
13 finished their research and development phase on the concept  
14 of geologic disposal in crystalline bedrock, and they have  
15 written an EIS which is now out for review. There's been a  
16 special panel formed within Canada to look at this and review  
17 it, and make recommendations within the next few years as to  
18 what the next step in Canada will be with regards to waste  
19 management.

20           Finland. Finland has cooperated tremendously with  
21 Sweden, and their concept is basically identical to the SKB  
22 project that I showed you earlier, and, again, it's all the  
23 same. Right now, TVO, which is the utility that is charged  
24 with responsibility of disposing of the waste has selected  
25 five sites to characterize, and this process was a voluntary

1 process. They had gone out and looked for communities that  
2 were willing to take on the responsibility of having them  
3 characterize sites, and it's worked out very well. They  
4 intend to select one site for detailed site characterization  
5 sometime in the year about 2000.

6           France. The waste form is high-level waste in  
7 borosilicate glass, which they developed. The geologic media  
8 that they're looking at right now is, again, I'll say  
9 argillaceous rock, and also crystalline, The canister is a  
10 stainless steel canister that houses the vitrified waste,  
11 with a carbon steel overpack. I don't know if they have--are  
12 figuring on a buffer or not. Right now, the French law has  
13 mandated three areas of research for waste management:

14           One is the geologic disposal concept. The law says  
15 that ANDRA, which is the agency responsible, should site two  
16 underground research laboratories to do research in. If this  
17 is to be--if any of these sites are to be turned into  
18 repository sites, the National Assembly of France will have  
19 to pass a new law that actually says this. In France, it's  
20 only research and development.

21           The other two areas of research are transmutation  
22 and partitioning of radionuclides, and the third one is  
23 simply long-term storage of the waste material.

24           As I said, four sites have been selected, three in  
25 the argillaceous media and one in the crystalline

1 environment, and, again, this was done on a voluntary siting  
2 basis.

3           Germany. The waste form is vitrified high-level  
4 waste, and now there's a possibility that there will be  
5 direct disposal of spent fuel within the German concept.  
6 Right now, the geologic medium is the Salt Dome at Gorleben.  
7 It utilizes thick wall cast iron canister, and because it's  
8 salt, there is no buffer material. Right now, there is a lot  
9 of discussion about what will be done in Germany with regards  
10 to the whole nuclear power program, and also, waste  
11 management. There is a possibility that the Gorleben site  
12 will be abandoned as a political tradeoff for some other  
13 parts of the nuclear program, and Germany has just recently  
14 begun cooperating on research programs within the OECD on  
15 both crystalline and argillaceous formations.

16           Italy. There is no program for disposal of high-  
17 level radioactive waste in Italy. Right now, the spent fuel  
18 is sitting at reactor sites.

19           Japan will also reprocess their waste and have  
20 vitrified high-level waste. They're considering many  
21 different rock types right now. They are in a research  
22 phase. They are investigating a thick wall steel overpack,  
23 very similar to the one that's being utilized by NAGRA in  
24 Switzerland, and also, consistent with the NAGRA approach,  
25 they're looking at highly-compacted bentonite as a buffer

1 material. Right now, there's been a steering committee that  
2 has been formed that is to look at the whole waste management  
3 disposal project and come up with policies, and also  
4 responsibilities of different organizations, and I don't know  
5 when they're actually going to come to any decisions.

6           Korea. There is no program for disposable high-  
7 level nuclear waste. They will have away from reactor--and  
8 this is supposed to be interim storage, not interior storage,  
9 although I suppose it'll be inside. They're going to go with  
10 a wet-type storage facility, and this is to be constructed by  
11 1997.

12         DR. CANTLON: This is South Korea?

13         DR. PATERA: This is South Korea, yes. You can read in  
14 the paper about North Korea.

15           Okay. The Netherlands. The Netherlands have just  
16 recently abandoned their research into the disposal of  
17 vitrified high-level waste in rock salt, and will now proceed  
18 with long-term storage.

19           Spain also has a high-level, vitrified high-level  
20 waste form. They are considering several media; salt,  
21 argillaceous rock, and also crystalline rock. Their  
22 reference canister and buffer system is a carbon steel  
23 overpack and a bentonite clay, but this has only been  
24 developed at a crystalline site, and the others haven't--they  
25 don't have other designs for the other media yet. They have

1 a siting process going on right now. Basically, it's to look  
2 at favorable attributes of these different geologic areas,  
3 and this is to be completed by the end of the year.

4           Sweden, I'll just go right to the status. They  
5 have a volunteer siting process underway. They want to enter  
6 what they call their demonstration phase, which is to build  
7 an encapsulation facility for spent fuel in the canisters,  
8 and this would be constructed near the CLAB facility in  
9 Oskarshamm that I showed, and then they would begin the  
10 construction of a repository on a limited basis, and a  
11 limited amount of spent fuel would be emplaced for a  
12 demonstration phase.

13           Switzerland. Reprocessing of their waste also  
14 provides them with a vitrified waste form. They're looking  
15 at both crystalline and clay formations. They're using a  
16 very thick steel overpack, and highly-compacted bentonite to  
17 form their long-lived waste package. They're currently  
18 assessing both the crystalline and clay formations; however,  
19 NAGRA's main emphasis right now is on the development of  
20 their low and intermediate level waste repository.

21           United Kingdom. Disposal program for high-level  
22 waste has been deferred while Nirex concentrates on the  
23 development of a low and intermediate level waste repository  
24 at the Sellafield site.

25           And, for completeness, here's the United States, so

1 that's all I have, and I would be happy to answer any  
2 questions, either now, or after the--

3 DR. ALLEN: Thank you very much.

4 Any questions? Don Langmuir?

5 DR. LANGMUIR: Obviously, the Swedes are trying to  
6 maximize the role of the waste package in the EBS in  
7 isolating the nuclear materials. Just for curiosity, and I  
8 think my numbers may need some help from you, the costs of  
9 the most expensive planned containment that's out there,  
10 apparently, the copper canister in Sweden, I look at our  
11 program, and if the numbers are approximately right, I figure  
12 it's going to cost us \$70,000 a ton to put our waste in the  
13 repository.

14 If you factor in the cost of the Swedish canister,  
15 what's it costing per ton for the Swedish program to put  
16 their waste in a repository?

17 DR. PATERA: I don't know the actual cost, but I know  
18 that what part of the law stated, that the whole Swedish  
19 geologic disposal system has to be indigenous, and,  
20 therefore, they have to have the capabilities and the  
21 materials within Sweden to do all of this, and their  
22 reference canister from KBS-III, which, as you know, is a  
23 very thick-walled canister, and also backfilled, or filled  
24 with copper. They looked at that, and the amount of copper  
25 that they'd need, which was for about, I think it's 8500

1 metric ton fuel, amounted to less than 3 per cent of the  
2 Swedish copper production, annual production.

3 DR. LANGMUIR: But the cost per ton, you don't have any  
4 idea what that is?

5 DR. PATERA: No, I don't. I remember, when I was in the  
6 crystalline program, I did a very quick calculation based on  
7 our own crystalline program, using the Swedish concept, using  
8 70,000 metric tons, and, as I remember, I came up with a cost  
9 of about \$600 million for the waste packages, and that  
10 included fabrication testing, and all that. It was based on  
11 a carbon steel. I just substituted the cost of materials for  
12 copper into iron, so I don't think it's out of the realm of  
13 possibility within the United States to use copper at all,  
14 especially considering, you know, if you look at it in  
15 perspective to the amounts of money we're spending in other  
16 areas of--

17 DR. ALLEN: Particularly if we put it in Arizona.

18 (Laughter.)

19 DR. ALLEN: Other questions from the Board?

20 (No audible response.)

21 DR. ALLEN: Well, thank you very much, and let me thank  
22 all the speakers up to this time.

23 We will now have a recess for fifteen minutes,  
24 until 3:35. Garry Brewer, do you have anything you want to  
25 say at this time, or--

1 DR. BREWER: I'll wait.

2 DR. ALLEN: We'll reconvene in 15 minutes.

3 (Whereupon, a brief recess was taken.)

4 ROUNDTABLE DISCUSSION

5 DR. BREWER: This is the final part of the program and,  
6 as Clarence Allen said much earlier, strong opinions have  
7 been expressed over the relationship between engineered and  
8 natural barriers; in particular, the extent to which  
9 engineered barriers can be used to offset deficiencies in the  
10 natural ones. Jean Younker gave us some idea of the  
11 functions of these different barriers in the DOE's Yucca  
12 Mountain waste isolation strategy in her presentation this  
13 afternoon. We've also heard a summary, a very good summary,  
14 of the way it's done in other countries with the experience  
15 of using the natural barriers almost entirely to engineered.  
16 The Board itself has made some limited comments in this  
17 area. We've continually urged the DOE to devote more effort  
18 to the development of robust waste packages, and we view the  
19 threat of earthquake ground motion as distinct from fault  
20 displacement as being for design and construction in terms of  
21 it's problematic than one of site suitability.

22 Okay. The topic for this roundtable this afternoon  
23 is engineered and natural barriers; the role they can play,  
24 the role they should play, how they fit within the assessment  
25 of site suitability, and ultimately the thing that we're all

1 here for, what's the tradeoff when you're talking about  
2 building a safe repository. We have numerous questions that,  
3 in principle, we could get to and probably will cover some  
4 segment of them in the course of the discussion here.

5           To remind a few of you who have not seen or  
6 participated in the roundtable format that the Board has  
7 adopted here within the last year, basically we try to get  
8 the discussion started by cuing on individuals who have made  
9 presentations earlier in the day. The idea is often to get  
10 summary comments, to clarify, or to elicit differences of  
11 viewpoint and opinion. We will do that. I'm prepared to  
12 invite representatives from the DOE, the NRC, and the State  
13 of Nevada to make initial presentations of about five minutes  
14 apiece and in that order. After that, basically what  
15 happens--and, it's a wonderful thing to watch--people start  
16 asking each other questions and one thing leads to another,  
17 rather like parts of the day today. We get away from the  
18 flip charts and the canned presentations. We have serious  
19 discussion among serious people about a real hard problem.  
20 And, I think the Board has been really satisfied with the  
21 roundtable format, even though it comes typically, as it does  
22 today, at the end of a long day with a lot of material. It  
23 has been a positive thing in our view.

24           I would like to begin the session--oh, and by the  
25 way, I'm the ringmaster. So, I will point to people and try

1 to keep the conversation going. I've got a few questions  
2 that I've thought of and a few that our staff has thought of.  
3 We, typically, never get to that point because of the kinds  
4 of conversations that get started. But, I'm ready in case  
5 things sort of flag. We're scheduled to go until about 5:30.  
6 That was the original agenda. We're getting a little bit of  
7 a late start. Clarence Allen says that his summary comments  
8 will be terse; will be thank you, goodbye, I think something  
9 on that order, right, Clarence? Okay. We will always leave  
10 time at the end of the session for public comment for anyone  
11 who wants to do that and I'm prepared for 15 or 20 minutes at  
12 the end; so, we'll work back. And, about an hour and a half  
13 for the roundtable in round numbers.

14           Okay. I'd like to start quick self-introductions,  
15 and we can start over here; just your name, rank, and serial  
16 number, and basically kind of who you represent, please.

17       MR. CLARKE: Okay. I'm Bill Clarke, the technical--  
18 officer for Livermore National Laboratory.

19       DR. BREWER: Thanks, Bill.

20       DR. STEINDLER: Martin Steindler, currently chairman of  
21 the Advisory Committee on Nuclear Waste to the NRC.

22       DR. BREWER: Thank you.

23       MR. BINGHAM: I'm Felton Bingham from Sandia National  
24 Labs, formerly connected with the Yucca Mountain Project, but  
25 no more.

1 DR. KNAPP: Malcolm Knapp, Nuclear Regulatory  
2 Commission, director of the waste management division.

3 DR. BREWER: Thank you, Malcolm.

4 DR. CANEPA: Julie Canepa, Los Alamos National  
5 Laboratory, technical project officer.

6 DR. BREWER: Thank you, Julie.

7 DR. ROSEBOOM: Gene Roseboom. I'm now retired from the  
8 USGS three weeks ago and in an Emeritus status.

9 MR. MAGAVERN: Bill Magavern, the director of Public  
10 Citizens Critical Mass Energy Project in Washington.

11 DR. BREWER: Thanks, Bill.

12 DR. WHIPPLE: Chris Whipple, chairman of the National  
13 Research Council's Board on Radioactive Waste Management.

14 MR. FRISHMAN: Steve Frishman, the Nevada Agency for  
15 Nuclear Projects.

16 MR. CURTISS: Jim Curtiss with the Washington, D.C. law  
17 firm of Winston and Strawn.

18 DR. MIEGROET: J. Van Miegroet, Belgium.

19 DR. BROCOUM: Steve Brocoum, assistant manager to  
20 Licensing, Yucca Mountain Project.

21 DR. PATERA: Ned Patera with Los Alamos National  
22 Laboratory.

23 DR. YOUNKER: Jean Younker with TRW, the M&O, and  
24 Regulatory Licensing Manager.

25 MR. KRAFT: Steven Kraft, Nuclear Energy Institute.

1 DR. COTTON: Tom Cotton with JK Research Associates and  
2 I'm on the senior staff of the M&O.

3 DR. BREWER: Okay. We know who the players are.

4 I'd like to start by inviting Steve Brocoum to  
5 spend about five minutes; a short summary of DOE's views on  
6 engineered and natural barriers.

7 I am reminded here that when you take a moment to  
8 be sure that you speak into the microphone because everything  
9 here is being recorded, it just takes an extra second. And,  
10 identify yourselves; that's another thing that's often a  
11 problem because poor Scott Ford, our long-suffering keeper of  
12 the minutes, doesn't know who you are and he's sitting there.  
13 So, identify yourself and speak into the microphone.

14 DR. BROCOUM: Some of these, I will put on the table.  
15 Earlier, you had me associated with TRW. I am not getting  
16 three paychecks.

17 What insight can we get from the regulation? I  
18 assume Mal Knapp is going to tell us the requirements of the  
19 regulation. I just wanted to make a couple of comments here  
20 that we get out of part 60 that I may not have said. In  
21 60.102, during the first several hundred years when radiation  
22 and thermal levels are high and certainties are large,  
23 special emphasis is placed upon the ability to contain the  
24 waste with an engineered barrier system; several hundred  
25 years. Following the containment period, special emphasis is

1 placed on the characteristics of a geologic repository. The  
2 engineered barrier system works to control the release. The  
3 geologic setting works to control release to the accessible  
4 environment; out of 60. Later on, the design of any  
5 engineered barrier shall contribute to the containment and  
6 isolation of radionuclides. Also, later on, engineered  
7 barriers shall be designed to assist the geologic setting in  
8 meeting the performance objectives for the period following  
9 permanent closure. That's some of the insights.

10           The NRC staff when they were wrestling on public  
11 comments to the proposed rule in their NUREG 0804 had a lot  
12 of discussion on uncertainties with the engineered barrier  
13 system, uncertainties with the natural barrier system, and  
14 they pointed out that having multiple barriers, defense-in-  
15 depth, will help compensate if there's unanticipated events  
16 or processes that you haven't either characterized or  
17 understood. They had a quote there, a summary quote: "Hence,  
18 confidence in the geologic record compensates for the  
19 uncertainty in the survivability of engineering; while  
20 confidence and containment for initial period compensates for  
21 uncertainty in geochemical retardation."

22           A couple of comments. In our view and in our new  
23 proposed approach, confidence in the system performance is  
24 gained by early reliance on the safety of the engineered  
25 components. High confidence in site performance during

1 operation is based on demonstrations of retrieval,  
2 criticality control, and the robust long-life waste canister.  
3 As we said, we may not have as much information as we  
4 planned to have at the end of site--originally, with the site  
5 characterization plan. So, we will continue the performance  
6 confirmation to reduce uncertainty as we collect more  
7 information even beyond the license application. That will  
8 help us increase understanding about performance of a system  
9 on the basis of a performance confirmation results, help us  
10 maybe to reduce the uncertainties. We hope to maintain the  
11 flexibility to improve performance of the overall repository  
12 and the confirmation by perhaps changing the thermal loading  
13 or making other changes before we close it. The natural  
14 barriers, in addition to the engineered barriers, provide the  
15 defense-in-depth by, shifting focus in the long time period  
16 to geologic processes, low-flux, slow releases, long travel  
17 times, potential retardation along flow paths.

18           We've tried to capture this concept in a diagram,  
19 as always. During the operational phase, we will depend on  
20 retrievability, criticality control, robust canisters. We  
21 have to understand these very well. That's why we are going  
22 to have a Title 2 design for the canister. After the  
23 operational phase and beyond the containment phase, we have  
24 to depend on gradual releases, subsystem requirements, and  
25 the natural barriers. So, the defense-in-depth concept is

1 kind of putting this all together, a little more reliability  
2 of this in the earlier time frames, reliability on the whole  
3 thing, and increasing reliability on this in the longer out-  
4 time periods, whatever those time periods may end up being;  
5 now, 10,000 years.

6           That's basically my five minutes.

7       DR. BREWER: Okay. Thank you, Steve. There's five  
8 minutes on engineered and natural barriers from DOE.

9           We'd like to turn next to Malcolm Knapp to get a  
10 view from the NRC and then we're going to follow that with  
11 five minutes of Steve Frishman from Nevada.

12       DR. KNAPP: First, I'd like to thank Steve Brocoum for  
13 enabling me to cut my talk to three minutes.

14           One or two philosophical thoughts that go back to  
15 the initial development of 10 CFR 60. As Steve has said, our  
16 interest in multiple barriers at that time was to increase  
17 our confidence that the repository would remain robust in the  
18 face of unforeseen events. That if the geologic system  
19 failed for reasons we didn't understand, we would have  
20 reliance on the engineered system and vice-versa. I note  
21 that those thoughts occurred before our experience with  
22 Hubble, Voyager, and Challenger. I'm sorry to say that we  
23 foresaw that sort of problem. I wish they had not happened.  
24 I also note that we had a philosophy that engineered  
25 barriers were not to be used to compensate for an otherwise

1 unacceptable site.

2           Very briefly, the nature of the barriers--perhaps  
3 most of interest today, a 300,000 year waste package, 1,000  
4 year groundwater travel time--what we had in mind was that  
5 these barriers would serve during some of the initial years,  
6 say, approximately, 1,000, over which we would have a  
7 substantial reduction in the toxicity of the waste and, as we  
8 saw it at the time, a substantial reduction in the thermal  
9 pulse as a result of emplacement of the waste.

10           In particular, with respect to the groundwater  
11 travel time, we had in mind a simple, we thought at the time,  
12 measure of the performance of the geologic setting, one which  
13 was a measure, not a prediction. It was our expectation that  
14 by measuring such things as permeability, porosity, head, age  
15 dating, that we would be able to get an estimate of  
16 groundwater travel time now rather than have to predict  
17 performance far into the future based on the result of  
18 accelerated tests.

19           A couple of other items concerning Part 60, it does  
20 recognize the need for flexibility. The rule does give the  
21 commissioners an opportunity to select some other, for  
22 example, groundwater travel time, given the right basis.  
23 This flexibility was included, in part, because we knew then  
24 that we would be smarter today than we were and, frankly, I  
25 expect we will be smarter in 2001 than we are today. It was

1 also included, in part, as a recognition that if we had a  
2 groundwater travel time of, say, slightly less than 1,000  
3 years, yet otherwise we were entirely satisfied with the  
4 performance of the repository, we did not want an opportunity  
5 to overturn the process on what could amount to a  
6 technicality.

7           That's something of the history of how we came up  
8 with the barriers. Today, I think we feel as we did then.  
9 Certainly, with respect to the numbers in the barriers and  
10 conceivably the barriers themselves, my interest is in  
11 insuring that we do have some sort of protection from both  
12 the engineered system and the geologic setting. If there are  
13 other more workable ideas which would accomplish the same  
14 goal, I'm certainly prepared to consider them and, if they  
15 seem to make more sense than what we have, I'm prepared to  
16 suggest that the commissioners themselves consider them.  
17 Candidly, since I've been with the program, I've heard  
18 concerns about some of the barriers raised, but I have not  
19 seen viable alternatives across my desk. That doesn't mean  
20 they're not out there; I just haven't seen them yet.

21           DR. BREWER: Thank you very much.

22           Steve Frishman from Nevada?

23           MR. FRISHMAN: I think there's value in remembering the  
24 reasoning as related by Mal.

25           We have an expectation that was created by the

1 Nuclear Waste Policy Act and also a long history behind that  
2 expectation that led to the concept of essentially the  
3 adoption of geologic disposal as the national policy. And,  
4 that expectation shows up in the Waste Policy Act in the  
5 statement that I read this morning from 112(a) referring to  
6 geology being primary and the factors that qualify and  
7 disqualify a site. In the guidelines, themselves, there's a  
8 reiteration of that. Engineered barriers shall be designed  
9 to compliment natural barriers which provide the primary  
10 means for waste isolation. There was acknowledgement at the  
11 time of the writing of the guidelines that the Waste Policy  
12 Act was serious.

13           In the NRC's concurrence proceeding on the  
14 guidelines, the idea of not compensating for adverse  
15 characteristics of a site with engineered barriers became  
16 something of an issue and it wasn't until, I think, a second  
17 or third meeting that that issue really came to a head. The  
18 states, I think, unanimously insisted that that issue had to  
19 be dealt with. I think it was primarily Commissioner  
20 Asselstine who managed to get the language finally into the  
21 concurrence understanding. And, at the time, you can try to-  
22 -well, you can try to discount it in the guidelines because  
23 it's spoken to in reference to when you're making  
24 comparisons among sites. But, that was only, I think,  
25 misfortune and ignorance on our part that in 1987 the whole

1 world would change on us. I don't think that there's  
2 anything special about whether you compare sites based on  
3 engineering barriers or whether you talk about engineered  
4 barriers at a single site.

5           The promise in the Waste Policy Act really goes at  
6 least back to the great gathering in 1957 looking at geologic  
7 disposal and whether geologic disposal is even reasonable to  
8 think about. At that time, I don't--I haven't recently  
9 searched the proceedings, but I don't recall a lot of  
10 discussion in what I have read of all of that about  
11 engineered barriers. The question was can we gain confidence  
12 in geology? And, the answer was maybe. I'm not sure that we  
13 progressed very much beyond that when the '82 Act was  
14 written. We may be better and we may be worse now, but the  
15 debate that's going on is making me wonder about the years  
16 past when I believe geologic disposal was possible. And, the  
17 reason I'm wondering about it is because I see it coming up  
18 as an issue not because of geologic disposal as being the  
19 policy in this country, but because we have a site that  
20 causes some particular problems and having to deal with it  
21 and it looks to me like sort of another way out.

22           Now, in the long-term, the engineered barrier  
23 really doesn't mean anything, anyway. When we're looking  
24 very long-term, if we're trying to really isolate these  
25 wastes over the very long-term from the environment, because

1 for the period of time of some of the way out bad actors,  
2 there's no way, at all, that you can rely on an engineered  
3 barrier; things like neptunium.

4           So, now, in the short-term we're looking at it and  
5 I can understand the reasons for a very short-term trying to  
6 assure the safety; you know, even at a time when you may find  
7 it necessary to go back and do something with that waste that  
8 you emplace. But, we have to remember 10,000 years is  
9 artificial. We also have to remember that 1,000 years is  
10 essentially arbitrary. It's as good a number as any,  
11 probably. But, we also should not be in the position of  
12 looking at these arbitrary numbers of years and doing what  
13 the Department has asked the NRC to do and the NRC has agreed  
14 to do now, which is to give credit for a container beyond  
15 1,000 years. And, that again, I see as a function of the  
16 site and problems with trying to have the confidence that you  
17 understand the geology and the site and I, for one, being a  
18 geologist, am not going to be interested in trading  
19 confidence for or lack of confidence for our knowledge of a  
20 particularly complicated site, trading that for some engineer  
21 telling me I can fix it and you'd better believe me.

22           DR. BREWER: Okay. Thank you, Steve.

23           In my role as ringmaster--this is moderator--I  
24 think I'd like to start the discussion and try to really  
25 follow directly on Steve's points. I'm going to ask both

1 Marty and Chris Whipple from their positions of having  
2 actually commented, thought about, written, taken public  
3 positions on this issue to really address Steve's  
4 observations or comments.

5 Chris, do you want to start?

6 DR. WHIPPLE: Okay. Let me go off on two digressions  
7 and I'll come back to Steve's comments as kind of a closeout.

8 First, I'm sorry to talk to everybody from the back  
9 of my head. I hope the glare isn't too bad.

10 DR. BREWER: You get used to it.

11 DR. WHIPPLE: I'm used to it.

12 All right. Second, also a brief comment. I  
13 apologize I wasn't able to be here this morning when the role  
14 of the National Academy and the site suitability work was  
15 discussed. I'm not too sorry I wasn't here, but nonetheless  
16 a quick comment there just to tell you what I think we're  
17 going to be doing is doing technical reviews of documents.  
18 We will not be assessing the site suitability. That is  
19 somewhere else that whole collection of reviews the Academy  
20 will have done will have to be knitted together. And, under  
21 those terms, I think what we propose to do is doable.

22 All right. Back to the question of engineered  
23 barriers and I really want to attack this from my own angle  
24 because I'm an engineer and I think engineers have a  
25 perspective on this that's different from the regulatory one

1 and that's what I want to start with. My view is that  
2 engineered barriers can do four things for you. First is  
3 they can delay the time to which the waste package starts  
4 leaking and that's a time that you get to add to the travel  
5 time to the environment. The second thing they can do is if  
6 they're cleverly constructed, they can reduce the release  
7 rate from the waste packages once they start leaking. A  
8 third thing they can do is they can prolong the time in which  
9 retrieval is comparatively easy and I emphasize  
10 "comparatively" and make retrieval safer if future societies  
11 decide that that's something they want to do. And, I frankly  
12 think that's a reasonably likely prospect for a repository  
13 that someday somebody will say let's go get that stuff and it  
14 wouldn't be all bad if we made that something safer. The  
15 fourth thing it can do for you comes out of my own experience  
16 in working with chemical hazards and contamination. The  
17 track record of the last half century has been that we're  
18 going back and fixing a lot of things that were done to the  
19 state-of-the-art of their time. The possibility that we may  
20 want to remediate a repository some time in the next few  
21 thousand years is not something that we should be so arrogant  
22 to dismiss. The longer we can keep the waste tightly  
23 contained in manageable packages, so that the people who are  
24 possibly a lot better at such things than we are 1,000 years  
25 from now can get in and patch up our work, I think again

1 that's a responsible thing to take on and I think that's a  
2 real clear role for engineered barrier.

3           Back quickly to the first thing I mentioned about  
4 the time considerations, you can think of that in time  
5 constants. In round numbers, a Yucca Mountain repository  
6 would have a gas pathway on the order of 100 years, give or  
7 take 95 maybe. It would have a groundwater pathway on the  
8 order of maybe 100 times that, maybe 10,000 years, give or  
9 take. You can compare that to the potential life of package  
10 designs and to the lifetime of the isotopes you need to  
11 contain. When I do that, it occurs to me that the short life  
12 stuff, the 30 year fission products, the americium, are not  
13 problems under any circumstances. They just can't move fast  
14 enough to become a problem. Carbon-14 is a fascinating case.  
15 It occupies much of my days which I think is why the NAS has  
16 asked to go look at the waste standard. But, on the order of  
17 a 5,000 year half-life and the short travel time, I think  
18 it's technically feasible to contain Carbon-14 until it goes  
19 away and I think there's not been a whole lot of serious  
20 debate on that particular problem. And then, as you look at  
21 the groundwater side, you then move out into a bunch of  $2 \times 10$   
22 to the somethings, 25,000 years for plutonium, 200,000 for  
23 technetium, 2 million for neptunium, 20 million for iodine-  
24 129. And, even the most ardent engineer gets discouraged  
25 when presented with those kind of numbers, but there is a

1 point to try to look at those benefits. As I say, I think  
2 the points I made about retrievability and the capacity to  
3 remediate are things to not be lost.

4           Now, finally, to return to the last question and  
5 that's the issue of engineered barriers and its role in site  
6 suitability evaluation, I think this is a substantially ideal  
7 demonstration of the mischief that happens when you apply  
8 criteria developed for site selection to the question of  
9 engineering design. And, we're talking about engineered  
10 barriers as a design problem and, there, the notion that you  
11 can't fix a bad site by good engineering, it just falls on  
12 its head. I mean, it would be irresponsible to do  
13 engineering that wasn't as clever as you could make it.  
14 Quite separate from whatever logic that rule had in the days  
15 of trying to winnow down and throw out the lousy sites and  
16 end up with the good sites, I think that the time has passed  
17 for that idea and that I think the depressing aspect of how  
18 the engineering design is being used here came in this  
19 afternoon's session in which Jean's presentation defined  
20 long-term canisters as 1,000 years and Ned described it as a  
21 million years. I think we're got our sights set in the mud,  
22 and we need to think more ambitiously and cleverly about what  
23 we can do.

24           DR. BREWER: Thank you very much.

25           Marty, you in the past have had views and I'm sure

1 you do still. Marty Steindler?

2 DR. STEINDLER: I think I'm constrained to give you a  
3 legal statement that says that the Advisory Committee on  
4 Nuclear Waste has not formally taken up this issue.  
5 Therefore, what you hear is largely my own speculation.

6 DR. BREWER: That's what I asked.

7 DR. STEINDLER: Having said all that, I guess I'm free  
8 to speculate at random.

9 DR. BREWER: That's what you're asked to do, yes, sir.

10 DR. STEINDLER: Let me focus entirely on the issue of  
11 tradeoffs and simply give you a number of statements and see  
12 whether they make any sense.

13 First off, it's my contention that the focus of a  
14 licensing process is the protection of the health and safety  
15 of the public. All other things are substantially trivial.  
16 From there, I move to Part 960 and I look at 960 and it's  
17 basically silent on the engineered barrier system with a  
18 couple of very minor exceptions that really have nothing to  
19 do with the statement, "may you or may you not exercise  
20 tradeoff?"

21 I move from there to some commentary on Part 60 and  
22 I look at 60 and it also, of course, doesn't say anything  
23 about tradeoffs. On the other hand, it also doesn't say  
24 anything about performance allocation and allows whoever is  
25 going to be making decisions to pick their own performance

1 allocation between the engineered barrier system and the  
2 geology. There are a whole bunch of places where that kind  
3 of thing applies which we can dig out of the regulations.  
4 But, most important, I think, there are a sufficient number  
5 of places in the regulations--one assumes they were carefully  
6 worded by Mal and company some years ago--which clearly  
7 indicate that the two factors, geology and the engineered  
8 barrier system, are to work in concert in some fashion or  
9 another that certainly allows you to look at the question of  
10 who does what or which particular facet of protection is  
11 exercised by those.

12           Let me go back then to the general notion of the  
13 regulation and I trust it's going to come out this way,  
14 although we've had experience in which it is not; that is,  
15 presumably, the new regulation should be based on some kind  
16 of risk standard. The EPA approach is to set generally  
17 applicable standards on the basis of risk and one assumes  
18 then if that nice, but at the moment not palatable to  
19 everybody, notion is followed, then the NRC's bottom line is  
20 somehow to identify what has to be done in order to get to a  
21 particular level of risk. Well, if Part 60 does not forbid  
22 exchanging some aspect of the engineered barrier performance  
23 for some aspect of the relatively unsatisfactory function of  
24 the geology and if we continue to address the issue in terms  
25 of the regulations at the 10,000 year mark rather than to

1 begin to extrapolate this to infinity, then it seems  
2 reasonable that there is some certain flexibility in that  
3 general performance apportionment in that 10,000 year time  
4 frame that's allowed. So, what is required? The Part 60  
5 requirements are the three subsystem criteria. The 1,000  
6 year groundwater travel time which at some other forum I will  
7 tell you, I think, is a now long outdated and powerfully  
8 unjustifiable subsystem criterion. The one part in the  $10^5$   
9 which is probably useful and can easily be met by  
10 engineering, and I'll get to Steve's distrust of engineers in  
11 a second. And then, of course, the substantially complete  
12 containment for 300 or 1,000 years; at least the short-life  
13 folks have gone away by that time. And, there's this minor  
14 problem of the 50 year retrievability which is being  
15 artificially escalated to 100 years under the somewhat  
16 mistaken notion that you can get solid, additional geology  
17 data in that small 50 year period.

18           So, you know, as far as the geology is concerned,  
19 Part 60 calls for some kind of an appropriate combination  
20 together with the engineered barrier system. All of that,  
21 you know, drives me to the conclusion that, within reason, I  
22 see no particular technical justification for the rigorous  
23 adherence to the requirements of defense-in-depth to the  
24 point where we're currently doing it. If the bottom line--  
25 and, I think that's the key, the key caveat--is adherence to

1 some kind of a process that involves quantification of  
2 uncertainties, the thing that concerns me about the current  
3 PPA approach is whether or not they will be able to quantify  
4 uncertainties sufficiently in their current model development  
5 based on bounding assumptions and that an evaluatable product  
6 is going to come out.

7           My final comment is about Steve's concern that he  
8 isn't going to believe the engineers. I think if he lives  
9 long enough and I don't think any of us will--all of us in  
10 this roundtable probably will not--we are certainly going to  
11 have to be at least mildly convinced by some engineering  
12 estimates whether we're geologists or engineers.

13       DR. BREWER: Thank you, Marty. Thank you very much.

14           I think I would like to ask an engineer what he  
15 thinks. I'm thinking about Bill Clarke.

16       MR. CLARKE: Can I use one viewgraph?

17       DR. BREWER: One viewgraph, all right.

18       MR. CLARKE: And then, I'll sit down with it.

19       DR. BREWER: And then, you sit down with it, right.

20           While he's getting ready with his viewgraph, the  
21 whole business of safety and so on, I want to come to Jim  
22 Curtiss and get your views next.

23       MR. CLARKE: One of my concerns throughout this program  
24 in the five years that I've been around is I don't think that  
25 most of us have sat back and looked in any detail of the

1 tortuous path that that water has got to go through to get  
2 into that fuel and back out into the environment again. If  
3 you take a look at the natural system, the uncertainty of the  
4 engineered system originates there and that's in the water  
5 contact mode. It's going to be extremely--to us in our  
6 modeling or whatever we do as to how much and what the  
7 quality of that water is and how it gets to the waste  
8 packages. If it gets in in the reflux mode and forms a  
9 continuous film, then we have all kinds of problems and  
10 things associated with microbiological corrosion, et cetera,  
11 et cetera. If it's a water drip, that's a different  
12 situation because now we've got probabilities of how many  
13 waste packages are under that particular drip and on and on,  
14 and is that drip enough to eventually fill a 5 foot by 18  
15 foot long container because that's the only way I can think  
16 of to get through all those barriers and ooze that stuff back  
17 out onto the ground again. The other way, of course, would  
18 be some incredible event. And, incredible in my mind is that  
19 it may, in fact, flood a drift. Now, we have an immersion  
20 problem and all of the corrosion phenomena that we're  
21 concerned about comes into play.

22           But, look at what we've got to do. We've got to  
23 get the natural system water mobilized. We've got to get it  
24 through some kind of a drift spacing if that's what we use or  
25 a packing if that's what we eventually get to. We've got to

1 get it through multi-layer waste containers. We've got to  
2 now, even though we may not take credit for it because it's  
3 not the right material, we've got to get it through an MPC  
4 wall. Fuel cladding--and, we can spend a whole day talking  
5 about that--but it's going to have to get through that. It's  
6 not all going to be filled. There's going to be just a small  
7 percentage. And, now, it's got to interact with the  
8 radionuclides or the fuel and that has now got to travel back  
9 out through that hole again.

10           Now, in a nuclear reactor, you have a driver. You  
11 have 1,000 or greater PSI pressure driving that back out  
12 through those cracks. Even when that happens, it's generally  
13 a very slow weeping process before guillotine fracture and I  
14 don't know of any that's really happened that way. So, we  
15 don't have that here and we're going to have a very difficult  
16 time getting that back out. And, even to mirror what Steve  
17 has said, it's the process in that and when you slow things  
18 down. I--slow things down for a very, very long period of  
19 time that certainly is going to help the Carbon-14 issue  
20 because there's a temperature effect. The temperature will  
21 decay. It's certainly going to help many other aspects of  
22 the controlled release. Everything there, by the way, is an  
23 additive of release rates for each one of those components.  
24 And so, my opinion, obviously being an engineer, is to say  
25 once we get out to B, we've got problems. Let's keep it in A

1 as long as we possibly can, and I think that we can do that.

2 DR. BREWER: Thank you, Bill.

3 I'm going to take this out of order. I'm reminded  
4 that it's probably time for the public to speak and I wanted  
5 Bill Magavern to really follow up directly after that if you  
6 care to.

7 MR. MAGAVERN: Yeah. I think that you have to consider  
8 that citizens have seen that the promises that have been made  
9 by and on behalf of the nuclear industry have been largely  
10 unfulfilled starting with too cheap to meter and going  
11 through waste dumps that leaked and partial core meltdown at  
12 Three Mile Island which we've been told couldn't happen  
13 because of defense-in-depth. And so, I think that people are  
14 going to look with a lot of skepticism at the promises of  
15 containment. I think that the promise of the Nuclear Waste  
16 Policy Act in 1982 was to find the best possible site, not to  
17 find a site that had a lot of problems and make up for it  
18 with engineering. The theme of today is site suitability and  
19 it seems to me that once you deem a site suitable, of course,  
20 you want to use whatever engineering you can to make it as  
21 safe as possible. But, first, you have to decide whether the  
22 site is suitable and I don't think that reliance on  
23 engineering can make up for deficiencies in the site.

24 DR. BREWER: Okay. Thank you very much.

25 Now, Jim Curtiss was for a time a commissioner of

1 the NRC and had to deal with this sort of routinely. Jim,  
2 I'd like to hear your view?

3 MR. CURTISS: Let me just preface my remarks by saying I  
4 can't take responsibility for Part 60 when it was originally  
5 promulgated. I didn't go back that far. But, let me key off  
6 of Marty Steindler's remarks and touch just briefly on what  
7 Bill Magavern has said because I largely share the views that  
8 Marty has expressed.

9 It's clear that, as a legal matter, the statute and  
10 the regulations permit reliance on both the geologic medium  
11 and engineered barriers. I happen to view the regulations in  
12 10 CFR Part 60 as a little bit more restrictive in terms of  
13 the tradeoffs that Marty spoke about and he described, and in  
14 fact, I think unless one resorts to the exemption procedure  
15 that Mal Knapp referred to which I think is going to be a  
16 difficult thing to do in the midst of a licensing proceeding,  
17 it's difficult to depart from what's in the subsystem  
18 performance criteria. But, the larger question, it seems to  
19 me, as we get down to this question of evaluating the  
20 relative relationship of a repository, the geologic medium,  
21 and the engineered barriers, is the tradeoff question and in  
22 the abstract I find that a very difficult question to  
23 evaluate absent some sense of what the overall performance  
24 measure--what Marty called the risk issue--clearly  
25 articulated is. My own personal view is that I don't think

1 we have that in 10 CFR Part 60 in the subsystem performance  
2 criteria. Beyond the qualitatively robust system that Mal  
3 Knapp referred to, one is hard put, I think, to define what  
4 the safety objective is of 10 CFR Part 60's subsystem  
5 performance criteria.

6           Secondly, it's in my view not the case today that  
7 those subsystem performance criteria are related in any  
8 direct way--what I've referred to previously as the nexus  
9 between the subsystem performance criteria and the EPA  
10 standards--and absent that overall sense of the performance  
11 objective of the repository, what the man and woman in the  
12 street are going to expect when we get to actually building  
13 this facility. It's very difficult in my view to draw the  
14 tradeoffs question or to address the tradeoffs question  
15 unless you've done that.

16           Now, let me pick up on a remark that Steve Kraft  
17 made earlier. In my view, the way to address that in the  
18 process that we're going about today as a result of the  
19 National Academy review and the ultimate promulgation of the  
20 EPA standards and the NRC regulations is to address clearly  
21 in the EPA standards what that safety objective will be and I  
22 assume that will happen. And then, perhaps more difficultly  
23 and Mal referred to this, define the relationship between the  
24 standard and the agency's implementing regulations that, in  
25 turn, will permit us to say what that objective is. And,

1 once we've done that, in my view, you'll be able to cast the  
2 tradeoff question in a more clear light.

3 DR. BREWER: Very good.

4 I wanted to turn next to Tom Cotton to really  
5 follow up on the question of tradeoffs and, after that, I  
6 wanted to go to Felton Bingham for--take the discussion to  
7 TSPA. I think that's kind of the logic of it here.

8 DR. COTTON: Okay. I'll just make a couple of  
9 observations on the tradeoff question. First is I'm not--  
10 it's pretty clear what tradeoffs between engineering and site  
11 fixtures mean when you're comparing sites. I can say, well,  
12 look, I could go with this site with this engineering and get  
13 this kind of performance. I could pick another site that  
14 maybe has less attractive features, but allows me to do a  
15 better engineering, maybe a copper canister, or something  
16 that will last for a very long time. It's not so clear what  
17 tradeoffs mean when you're talking about a particular site in  
18 deciding whether it is okay for a repository. The site is  
19 what it is. You're not trading off something about the site.  
20 I think what you are trading off is what Steve raised which  
21 we have to think about and that is are you trading off some  
22 level of understanding, an acquisition of more data about the  
23 site versus possibly putting more emphasis on engineering to  
24 compensate for uncertainties. But, you're not actually  
25 trading off features. I mean, the site is what it is.

1           If I go back and look at the guidelines, you know,  
2 Steve, you said that while they focused on comparisons, it  
3 also--and said you shouldn't use engineering to compensate  
4 for a bad site--that that also applies for suitability of a  
5 single site. But, even if you go back and look at the  
6 guidelines and the language that was approved by the  
7 Commission, even there it's not quite as black and white as  
8 that. It says that the comparative evaluations between sites  
9 would be done twice. Once, de-emphasizing the engineered  
10 barriers and emphasizing the natural barriers; and then,  
11 another comparison of performance, it takes full credit for  
12 the performance of the barriers and that when you make a  
13 selection among sites that the--and, comparison based on the  
14 performance of the natural barriers would take precedence  
15 unless the second comparison which took into account the  
16 performance of engineering made a significant difference. In  
17 which case, you would give equal weight to both comparisons.  
18 So, even in the guidelines, it's not quite as clear that  
19 there's just a blanket prohibition saying you can't really  
20 take credit for the performance of the engineered barriers,  
21 even at the site selection stage.

22           DR. BREWER: Anyone care to follow up on that?

23           Felton?

24           MR. BINGHAM: Leon suggested that since I was formerly  
25 tainted with performance assessment, I should try to report a

1 little on what the latest things in performance assessment  
2 are doing. And, since I'm sufficiently removed from them now  
3 to be sufficiently ignorant, I can be believed when I say  
4 something about it. I hope that what I have to say would be  
5 supported by the people who did them.

6           When I look at those performance assessments, I  
7 feel like I ought to remind everybody that when you talk  
8 about them, you're talking about parameters; kind of  
9 individual parameters and what the uncertainties in them are  
10 and how they depend on each other. I think Chris Whipple's  
11 little review of what gets out when and what time frames  
12 relieves me of the necessity to say a lot of the things that  
13 the latest performance assessments are showing because they  
14 are showing those things that are almost common sense.

15           It appears, for example, that under some conditions  
16 that are not inconsistent with the data about the way water  
17 moves through the Yucca Mountain site, there really isn't any  
18 need for containment except for the Carbon-14 problem, the  
19 one that keeps Chris Whipple awake at night. Under other  
20 conditions that are also consistent, it looks as though  
21 containers may play a more significant role than in addition  
22 to just holding in the Carbon-14 until things have gotten  
23 better. They could contribute to the kind of lengthening of  
24 time before the radionuclides start their travel outside,  
25 something else that Chris mentioned. But, when I thought

1 about that, it reminded me of what I thought about in the  
2 early '80s when there seemed to be becoming a lot more  
3 clamor, a lot more voices in the world talking about  
4 engineered barriers. I wasn't around in 1957--or I was  
5 around, but I wasn't much worried about radionuclide--I think  
6 we were mostly just delighted World War III hadn't started  
7 yet. But, at that time, the idea seemed to be that the  
8 geologic formation itself was the container. And, we all  
9 proceeded along that line. I remember hearing people saying  
10 things like what do you need a package for except to get it  
11 to the site until towards the late '70s and early '80s when  
12 Part 60 seemed to bring them up and everybody seemed to be  
13 taking a good deal more interest in them.

14           So, the thing that bothered us then and still  
15 bothers me now is how much uncertainty reduction will it take  
16 for a regulator to feel a state of reasonable assurance about  
17 engineered materials? Nature has done the million year  
18 experiment for us and that's what led the Academy in '57 to  
19 suggest that a can might be a geologic formation. Now,  
20 nature didn't have the subpart G QA program going during this  
21 experiment.

22           So, it's hard to be sure exactly what lessons to  
23 draw from. But, I think the hope has always been that when  
24 hydrologists, geologists, geophysicists, and all the folks of  
25 those stripes get together and argue long enough, they can

1 finally decide whether that can is going to work. But, when  
2 I think about experiments in corrosion and those are among  
3 the parameters that the latest performance assessments are  
4 identifying, when I think about the way you measure them--  
5 say, a five year experiment and I've measured a weight and I  
6 picture an access with weight on the Y and time on the X, and  
7 now I try to draw a dot from the origin to that point and  
8 then extrapolate it out for 5,000 years--what will a  
9 regulator, a reasonable person, say about my extrapolation?  
10 I think the regulator will probably feel justified in saying  
11 I believe you better be awfully conservative about that  
12 extrapolation you just did. If you really become very  
13 conservative in the role of engineered barriers in reducing  
14 uncertainties and giving assurance, it becomes a lot less  
15 than what I think we ought to hope it could be.

16           Is that enough?

17       DR. BREWER: Oh, that's wonderful.

18           I'm about to ask the people who have been or are  
19 related to the regulators your take on what Felton just had  
20 to say. Malcolm?

21       DR. KNAPP: First, what I had was that I share the  
22 concern about how you would extrapolate, say, five years to  
23 1,000. Back when I was doing something a little more  
24 technical and a little less bureaucratic for a living, I  
25 worried a lot about fluid/solid interactions. And, after

1 spending several years studying them, I decided I didn't  
2 understand them and I wasn't about to understand them. That  
3 what I could say was I could come up with some models which  
4 gave me an intuitive comfort that I described what was going  
5 on and I could manage to select coefficients that happened to  
6 fit the data, but--and, of course, this was back in the Dark  
7 Ages; that is to say the early '70s--without some of the  
8 gadgets we have today. But, I didn't have enough information  
9 to be able to say that's really what's going on. I could  
10 simply say I have an intuitive model which fits the data that  
11 I have and that made me a little nervous about extrapolation.

12           And so, I would follow with what Felton has said.  
13 I will want to see if either--I think we will either ask that  
14 people be very conservative or give me high confidence that  
15 we actually truly understand mechanistically what's going on,  
16 and I'll be interested in seeing that demonstration.

17       DR. BREWER: I'm going to ask Julie--because it's your  
18 job to convince him that you know what's going on--to  
19 comment, to follow up on the line of discussion here.

20       DR. CANEPA: Someone spoke earlier about tradeoffs and  
21 whether tradeoffs were a reasonable topic of discussion if  
22 we're not comparing sites and we're not selecting. And, I  
23 think, at least in the last year or so, in developing the  
24 proposed program approach, I think we've dealt with that  
25 issue and I think many of us thought we really were involved

1 in tradeoffs and I think you've been alluding to the issues  
2 here today talking about suitability and the engineered  
3 barrier system.

4           In essence, when we began the proposed program  
5 approach and we were dealing with some of the data collection  
6 and the modeling, say, that Livermore was doing with the hot  
7 repository concepts, we started to deal with that issue.  
8 And, I don't know if it's a real issue of tradeoffs, but all  
9 of a sudden, it started to perturb our world and we had to  
10 deal with it. I think the issues that--in listening to Bill  
11 and trying to continue a focused and directed  
12 characterization program that truly is addressing suitability  
13 and we don't lose sight of that, I think reasonable designs  
14 on the EBS are obviously critical for our evaluation of a  
15 reasonable suitability data set that would support or not  
16 support, I guess, a suitability decision. Bill mentioned,  
17 you know, basically, the uncertainty is the water contact and  
18 that's the uncertainty no matter what your thermal load is.  
19 It's currently the uncertainty on our system is water  
20 direction and water contact. And, basically, what he said  
21 and what we've learned is that current SCP designs, maybe  
22 that was the worst load, so to speak, that you had to deal  
23 with. So, we know that we have to look at the mountain under  
24 a very low load, but you're trying to control the water  
25 movement and water contact; or a very high thermal load

1 because you're trying to control the water contact. Now, for  
2 the geologists and chemists involved, it's important for us  
3 to determine essentially what is the perturbation of that  
4 natural system. And, almost more than just what the specific  
5 perturbation is, how much perturbation can the system handle  
6 and what the bounds on those perturbations are.

7           Now, you get into the difficulties of a couple  
8 processes. How much data do you really need to know in order  
9 to bound that perturbations to the system? I still maintain  
10 the greatest uncertainty in the system is your hydrology and  
11 that's really the perturbation that you're going to be--that  
12 you have to focus on regardless of the thermal stability.  
13 But, we certainly know, you know, the years, they're  
14 immaterial to us, the geochemists. We know exactly what  
15 nuclides we're supposed to be looking at. We know full well  
16 it's selenium, technetium, neptunium, plutonium, uranium.  
17 Regardless of your engineered barrier system, regardless of  
18 whether it's 1,000 year, 10,000, or 100,000 years, we know  
19 that's what it is.

20           So, we can handle--it's not unusual. We can handle  
21 the perturbations of the system in looking at the  
22 geochemistry. I think we're still within the bounds, but I  
23 worry very much that we are going to be locked into a very,  
24 very full, complete understanding of a couple processes and  
25 having a really secure, confident thermodynamic database in a

1 very short time period. I don't think anybody is sitting at  
2 this table that believes that that's really going to happen.  
3 I still believe you can make progress towards a suitability  
4 decision even without that.

5 DR. BREWER: Around the panel, anyone care to follow up  
6 on Julie's comments about the availability of data and the  
7 capacity to do the work? Anyone like to take that one on?  
8 Steve?

9 MR. KRAFT: Well, not to comment directly on the  
10 specific data set that Julie talked about because I'm not  
11 familiar with it, but let me just comment generally.

12 It may very well be that there is a data set that  
13 you can--because you can do it, you can do it out to  $10^5$ ,  $10^6$   
14 years. But, unless you take that data, apply some expert  
15 judgment as to how it might work in the system, and run it  
16 through some kind of models I was talking about earlier to  
17 assess the effect on real people in a real population because  
18 when you get to B, that's only the edge of the accessible  
19 environment. I want to know what goes on beyond B, as well,  
20 to that radionuclide.

21 The point being that you may very well learn in all  
22 the modeling that more investment in developing the data set  
23 doesn't matter because it doesn't affect the answer one way  
24 or the other, good or bad. Some radionuclides are going to  
25 just float through and get out into the environment and

1 you're going to have to look at natural processes because  
2 that's the nature of the radionuclide, and some will be  
3 retarded in the manmade structures or in the natural  
4 structures and never get out. And, more data isn't going to  
5 change your knowledge on that. So, forget it and go on to  
6 the next one.

7 DR. BREWER: Chris, did you want to follow up? Chris  
8 Whipple?

9 DR. WHIPPLE: I want to comment on the general flow here  
10 and what I've been hearing.

11 It seems that there's kind of a steady stream since  
12 1957 of a view that the engineering is very short-lived in  
13 comparison to geology, that we've moved through the period in  
14 which Part 60 said it may be true, but you've got to look at  
15 engineering anywhere. But, that was widely interpreted at  
16 the time to say, but we also limit the credit you can take  
17 for engineering. I know Bob Bernero clarified what was meant  
18 there, but it had a lasting effect that 1,000 years is all  
19 you get for engineering was the perception for while.

20 Similar views, such as Steve's talk today, which is  
21 we don't want to give you credit for fixing fundamental flaws  
22 in the site anyway. But have all that to a perception, as I  
23 understand it by the TRB and certainly by the NAS board in  
24 its rethinking on the high level waste report, that we've  
25 under-invested in work on the engineering side. And then, to

1 mess everything up, the Swedes come along and claim a million  
2 year package and can make a damn good case for it. And, I  
3 thought Ned's talk, in which he pointed out really the four  
4 kinds of evidence starting with corrosion rates and then  
5 going out looking at old ships and metal laying around and  
6 then older artifacts and then finally natural deposits of  
7 minerals, walked up a chain of evidence in which the short-  
8 term corrosion measurement case was clearly recognized as the  
9 most tenuous. And, extrapolation from that was indeed weak,  
10 but there were other principles of evidence, his Eh/pH  
11 tables, for example, that could give you higher confidence.

12           Now, I guess my observation through all this is  
13 that somehow in our effort to be conservative here, we've set  
14 high hurdles for accepting evidence regarding the  
15 capabilities of engineering systems to augment the  
16 performance of the geology. And, what we've perversely come  
17 up with is a disincentive to do any work in the field. I  
18 think that's the issue that TRB ought to try to address is  
19 how do we remove the disincentive that has since 1957 been  
20 felt by the program to do engineering work since it doesn't  
21 appear that they can get much credit for it.

22       DR. BREWER: To speak on the TRB's behalf, I think we  
23 have been nudging the subject along and trying to be  
24 constructive. At least, it's been mentioned in the last  
25 three reports that I have had a chance to read and

1 participate in. Ellis Verink is sitting there smiling and  
2 shaking his head yes, so I know I'm right.

3           Anyone else want to follow on the general point?  
4 It's a good one, I think; it's important.

5           MR. CLARKE: I want to get back to one of Felton's  
6 comments and he's absolutely right; trying to extrapolate to  
7 a long time is a very difficult process. But, I want to  
8 remind you that several years ago we faced the same problem  
9 in the nuclear industry. And, I remember that in the boiling  
10 water reactor business, we launched off on a 10 year effort  
11 to develop models to predict first time to failures and  
12 nuclear--and most of that work was done at Schenectady in the  
13 research facility there. And, after 10 years, they came up  
14 with a model based on all the mechanistic studies that we can  
15 do in that period of time which it very, very accurately now  
16 predicts first time to failure in a BWR plan. And, of  
17 course, they've gone to many, many mitigation processes to  
18 try to eliminate that and, in fact, we've gotten buy offs  
19 from the NRC to allow plants to continue running with cracks  
20 in them through a mid-cycle inspection which saved them a lot  
21 of money. Now, that's obviously only for a 40 year period,  
22 but in this case if we understand the processes, if we can  
23 develop the models, and one of the comments I made to Steve  
24 Brocoum when the plan was first introduced to the staff  
25 several months ago was that if we then could monitor those

1 packages in an open drift for 100 years and there's nothing  
2 wrong with another 10 years or whatever, then I think that we  
3 would have more confidence in making at least the  
4 substantially complete containment period with a much, much  
5 higher confidence than we had several years ago in the  
6 nuclear industry.

7 DR. BREWER: Anyone care to follow up on that? Bill, I  
8 think that's appropriate.

9 MR. MAGAVERN: Well, listening to some of the optimism  
10 about engineering, I just think that if we take that to a  
11 logical extreme, then it raises the question of if we can  
12 make packages that are so good, then why do we want to bury  
13 them, particularly given the importance of retrievability  
14 that Chris Whipple talked about?

15 DR. BREWER: Well, there's the question. Why do we want  
16 to bury them?

17 MR. KRAFT: I don't--why? I don't want to bury them.  
18 Certainly not within the first couple of hundred years, I'll  
19 know that it's necessary. I think that there are--there may  
20 be political and aesthetic reasons. There's probably no  
21 technical reason. The industry argued for many years that  
22 there was a technical reason to begin disposal, but that had  
23 little to do with the safety of the spent fuel. The most  
24 violent environment spent fuel ever sees or fuel ever sees is  
25 in the reactor itself; high pressure, high flow, large energy

1 content. The second probably most potential violent  
2 environment that it sees is in the transport accident. I  
3 mean, I don't mean to be flippant about it, but I think you  
4 can take spent fuel and put it in a paper bag underground for  
5 100 years and not violate anybody's standard except worker  
6 exposure. And, Felton made an interesting point about the  
7 early versions, early vision of what the package was for was  
8 really for handling and exposure. I, at one time early-on in  
9 my misspent career, I was on the ANSI 14.9 subcommittee and I  
10 was sitting at the table when we went from low level waste  
11 being disposed of in the ground in the package only for  
12 transport to the package being part of the disposal, and now  
13 you're at high integrity containers and all sorts of stuff.  
14 The point I'm trying to get at is that you don't necessarily  
15 have to do it, you don't necessarily have to bury it for the  
16 first 100 or 200 years. I think what you have to do and I  
17 think this came out in the Blanchard-Issacs report from last  
18 year or the year before--last year; I think what you have to  
19 do, I think, is make the commitments to generations that says  
20 we're going to keep on trying to figure out what to do in  
21 terms of ultimate disposal while we protect this stuff on the  
22 site or maybe underground in some storage facility, but not  
23 to dispose of it right away because there are things we need  
24 to learn.

25 DR. BREWER: Okay. I've got a followup from Tom and I

1 wanted to follow that. I'm wanting to think about it. Ned,  
2 in talking about how the Swedes get away with putting it all  
3 in a pool, just think about that. But, Tom next?

4 DR. COTTON: Just a quick response to Bill Magavern.  
5 And, that is I don't think anyone is claiming that the  
6 packages are so good that you can just sit them on the  
7 surface and leave them alone. I think that the idea, even  
8 with the Swedish one, is that you need a nice, stable, benign  
9 environment which the site provides. So, it really is a--  
10 and, even though they're emphasizing the life of the  
11 canister, the site and those chemical conditions are what you  
12 need in order to make the long life argument. So, even in  
13 those cases, there is an interaction between the need for a  
14 stable underground site and the canister.

15 DR. BREWER: Ned, your sort of take on the Swedes and  
16 why they're able to do what they're doing with it for 100 or  
17 however many years they're going to stick it in the pools?

18 DR. PATERA: Yeah. The CLAB facility was built to bring  
19 the waste to a storage facility and let it cool off prior to  
20 disposing of it. They have plans for expanding it, as I  
21 said, to all the spent fuel date are going to have, but they  
22 don't claim that they're going to store it forever. They  
23 want to have disposal, but gee, you know, after what Steve  
24 said, I think that what we see happening in a trend  
25 internationally is more discussion about long-term storage.

1 We see the case in the Netherlands where their environmental  
2 policy basically claimed that they had to have infinite  
3 retrieval for a geologic disposal. They said this is  
4 ridiculous in a salt environment; we'll just store it on the  
5 surface. We see the same thing in Korea, we see the same  
6 thing in Italy which is at reactor storage at the moment.  
7 The French are studying this also. Perhaps, it's time to  
8 open up the debate, whether geologic disposal really is the  
9 preferred method or whether long-term storage is the way to  
10 pass on to the next generation of a more responsible  
11 solution.

12 DR. BREWER: Gene Roseboom has thought about this and  
13 talked about it. Go after it, sir, if you would?

14 DR. ROSEBOOM: All of the sites that we've been talking  
15 about and other countries are, of course, saturated zones.  
16 And, in disposing in a saturated zone site, you have to try  
17 to reduce the amount of ground--you're going to be in a  
18 tunnel that is filled with groundwater and you have to try to  
19 reduce the rate of contact of such water with the waste. In  
20 an unsaturated zone site, we are simply largely dealing with  
21 drip water and perhaps some rapid flow of water down  
22 particular faults or fissure systems that hopefully, once we  
23 have explored the site, we can avoid. Furthermore, in an  
24 unsaturated zone site, we do not have to--because of this, we  
25 do not have to backfill and seal everything up forever. And,

1 I think there is a great value in trying to maintain long-  
2 term retrievability.

3           One of the arguments that I keep seeing in recent  
4 articles against mine geologic disposal is the fact that we  
5 are doing something that's irreversible and, therefore, it's  
6 much safer to leave it on the surface. Well, I would  
7 question what the certainties are with regard to society over  
8 the next 100 years or longer. We clearly facing a lot of  
9 problems in the next century and there's considerable  
10 literature on this subject.

11       DR. BREWER: Thank you very much.

12           I think, unless there's an immediate followup by  
13 one of the panel members, I think we've probably reached the  
14 point where it might be useful to turn to the DOE members of  
15 the panel who have been amazingly silent to just get your  
16 general--except for the opening comments from Steve--to get  
17 your general take on the things that are coming out of this  
18 roundtable; the idea of revisiting geologic disposal, the  
19 idea of tradeoffs, the idea of being citizens being able to  
20 cover up a lousy site with good engineering for a long period  
21 of time, to put it in the technical vernacular.

22           Steve, do you want to go first?

23       DR. BROCOUM: I'll make a couple of comments. I think  
24 the concept that disposal came along, the philosophy that

1 accompanied it, the generation that created the problem  
2 should be the generation to souse it. I think that  
3 philosophy is kind of imbedded in our program and in the  
4 Nuclear Waste Policy Act. One can make rational arguments  
5 for keeping it on the surface for a period of time, but I  
6 think the time the Act was passed, the thinking was solve the  
7 problem and remove it from the biosphere. I think Tom Cotton  
8 made the point very nicely about the Swedish program; that,  
9 again, it's a systems approach and it's underground and,  
10 regardless of whether you have a million/a billion year life,  
11 a billion year package or not, they're just having it 1500  
12 feet under the ground, I think it was--500 meters--adds a  
13 margin of safety even if you cannot quantify it.

14           Let me make a comment--two comments I want to make  
15 and I would like to take my DOE hat off for a few minutes if  
16 I can to make these comments. First, let's talk a little bit  
17 about mitigating a bad site by engineering. Let's think  
18 about that. What makes a good or a bad site? Let's put 960  
19 and 60 aside. Let's take the example of Ghost Dance Fault.  
20 Let's look at the Ghost Dance Fault. One could say, oh,  
21 geez, we have a fault in the middle of the site. That makes  
22 it a bad site. Let's assume water flows along that fault.  
23 Well, that fault drains, if you like, the site. I can see an  
24 engineering design where a fault that drains the site might  
25 --you might make a design so that is an advantage. In other

1 words, you're draining water away from the waste packages  
2 down this fault. Now, is that mitigating for a bad site or  
3 is that a good feature of that particular site? There's a  
4 lot of philosophical questions one can ask about features  
5 like this. So, in my own mind, I find it very difficult to  
6 talk about individual feature as good or bad. And, when you  
7 use engineering to take advantage of features of the site, is  
8 that mitigating for a bad site now putting 960 and 60 aside?

9           The second point is let me just raise another issue  
10 on the suitability of a site. One way one could look at the  
11 suitability of a site is is there anything I know about this  
12 site that prevents me, based on the currently available  
13 technology, from designing a repository for that particular  
14 site? Is not that the question we're asking about a site  
15 like Yucca Mountain? Putting again the regulations aside.

16           These are just comments I wanted to bring up to  
17 stimulate the discussion here. You know, if you--and, I took  
18 my DOE hat off so I could do this because I'm sure over the  
19 next meeting Mr. Frishman might raise some of the comments I  
20 made and throw them back at me. Now, I'll put my DOE hat  
21 back on.

22           DR. BREWER: Now, I wonder if Mr. Frishman wants to put  
23 a hat on or take it off or--Steve?

24           MR. FRISHMAN: Well, your point about what makes a good  
25 or bad site, I have to come back to something that I said

1 that at least a couple of people obviously heard when I was  
2 speaking earlier. And, that's that the real key to the  
3 natural barrier is being able to demonstrate that you  
4 understand it and that you understand that it is going to do  
5 things that greatly reduce your uncertainty about whether  
6 that waste is going to be isolated or not. The good and bad  
7 features or factors are essentially measured by how much  
8 uncertainty do they override into your ultimate confidence  
9 that you have isolated this waste from the biosphere?

10           And, I think you've got to start--even look at--  
11 there's a page in the 1980 EIS that selected geologic  
12 disposal. Look at the table in there. There's a table. I  
13 can't remember the page, but I've used it before. It lists a  
14 whole bunch of features that it suggests you may want to use  
15 as just rational excluders right away. The reason for that  
16 is because these are the things that throw very high  
17 uncertainty into your ability to predict that you will  
18 maintain isolation for a long time. And, the idea of trying  
19 to take things that create uncertainties and somehow, you  
20 know, translate that into the silver lining is--it's just  
21 kind of ridiculous to me when you have the option of not  
22 being in the position where you've got to decide and try to  
23 convince somebody that it's a good thing that fault is there  
24 and it's full of water when you could find a site that didn't  
25 have that fault in the first place.

1 DR. BREWER: Steve, did you want to come back?

2 DR. BROCOUM: Hat or no hat, I don't care. I'm not  
3 familiar with that table. But, that again was the view of  
4 the people that put that document together at the time. I  
5 think when you look at it in some total systems concept with  
6 a design in mind, those features may be irrelevant or they  
7 may be very relevant in terms of uncertainty.

8 DR. BREWER: Okay. Anyone else from DOE? Jean, you are  
9 amazingly quiet.

10 DR. YOUNKER: I think I maybe said everything I had to  
11 say on this topic earlier. I guess, the one comment I would  
12 make and this is kind of a philosophical sidestep from some  
13 of the more pointed discussion and that would be that my  
14 perspectives--I keep thinking as I listen to the discussion  
15 that some of the points made about, well, maybe we don't  
16 really have to move forward with permanent geologic disposal,  
17 there are options for either surface storage for a while that  
18 may make some sense, and, I think Steve Kraft said there may  
19 be reasons political or, you know, outside of the technical  
20 realm as to why that may or may not be possible.

21 DR. BREWER: What he said was "here comes the waste".

22 DR. YOUNKER: I heard that, too, yeah. All right.

23 But, I guess, just from a very philosophical  
24 viewpoint, I have the feeling that we're at a point in this  
25 program, a lot of money has been spent investigating this

1 particular site and the whole concept of geologic disposal.  
2 And, kind of stepping aside also from my DOE contractor--  
3 taking off my DOE contractor hat--as a citizen, I kind of  
4 hate to see us not go ahead if this is a good solution. I  
5 hate to see us not go forward with it in one form or another  
6 that's acceptable to the political situation that we find  
7 ourselves in. My inside information--I've answered this  
8 question when Leon Reiter asked me about Yucca Mountain--is  
9 that if you're going to go forward with some form of geologic  
10 disposal, everything I know about the site leads me to  
11 believe that this is probably a pretty good place to try it  
12 and probably also would make a pretty good place for an  
13 interim storage; all waste material that you'd like to keep  
14 away from the environment.

15           So, you know, I listened to all the scenarios that  
16 are possible and just kind of with the dollars that have been  
17 spent, I kind of have a sense of hoping that there's still a  
18 chance for a solution and some definition of a solution. You  
19 know, once again, philosophically, I think nuclear energy is  
20 an important energy source for the country and for the world  
21 and I worry about the impact of this program, the various  
22 outcomes of this program, on the total reliance on nuclear  
23 generated electricity in the world. So, kind of a  
24 philosophical sidestep, but I don't really have anything very  
25 pointed to add to the discussion, I believe.

1 DR. BREWER: No, that's fine. That's fine.

2 Yes, Marty?

3 DR. STEINDLER: Yeah, let me just make a couple  
4 of comments. The argument about whether or not you should,  
5 in fact, bury waste is ongoing and unresolvable by technical  
6 means. It's a societal decision. It's based on what society  
7 will accept as a risk. And, I remind you that a risk of  $10^{-6}$   
8 from nuclear is much worse than a risk of  $10^{-6}$  for driving a  
9 car or anything else you can think of if you go out and talk  
10 to people. The whole general notion of resource destruction  
11 by burying something that has clear value is another set  
12 aside issue. But, it seems to me that we keep talking about  
13 site suitability as though this was an isolated process or a  
14 thing that we're going to look at without having any  
15 particular relation to everything else that is supposed to go  
16 on in that site. Site suitability is an almost non sequitur  
17 taken in isolation. And, I think the central issue is site  
18 suitability for what which gets you to the question of can  
19 you quantify the uncertainties? And, the size of the  
20 uncertainty in any particular aspect of that site is again a  
21 non sequitur. It depends on the sum total by the time you  
22 get down to your total system's performance assessment.  
23 Unless you do that, all the other discussion is likely to be  
24 viewed at least by some of the technical folks, me included,  
25 as an excursion into politics. Not that that isn't necessary

1 for some folks, but it isn't necessary for me in this  
2 discussion.

3 DR. BREWER: Tom Cotton wants to follow on that.

4 DR. COTTON: This is on the subject that's come up a  
5 couple of times. You just raised it and it was raised  
6 earlier. That is this issue of whether to bury it or to  
7 store it for some period. In my view, that's a total red  
8 herring issue. It's totally unrelated to the question of  
9 whether we should go ahead and get an option for disposal.  
10 And then, the decision whether you actually then go ahead and  
11 bury it is another societal question and we may want to leave  
12 it on the surface to cool off. But, my sense in looking at  
13 some foreign programs--I won't name particular ones--is that  
14 the heat that they're trying to avoid by storing it for a  
15 long time on the surface is not the heat being put out by the  
16 waste. It's the political heat. Okay?

17 So, you know, when you look at what's the  
18 obligation to the future, my own personal view is that the  
19 price that this generation needs to pay is the political and  
20 intellectual prize of trying to figure out what is an  
21 acceptable solution at this point and go ahead and at least  
22 make that available for people to use and for our kids to  
23 use. Otherwise, if we say, gee, it's a wonderful idea, we'll  
24 store it, and wait for some non-obtainium (phonetic)  
25 canisters in 100 years, is that my kids or my grandkids or

1 going to be sitting around saying, oh, God, what are we going  
2 to do with this mess that they left us out at the site with  
3 the storage facility? They will not necessarily do that as a  
4 favor.

5 DR. BREWER: Ned, did you want to follow up?

6 DR. PATERA: Yeah. I think that when we discuss storage  
7 versus disposal, what we're talking about in disposal is a  
8 final solution and we walk away from it and we think we've  
9 washed our hands of any further responsibility for it with  
10 regards to future generations. I don't think this is the  
11 case. The human intrusion scenarios that run and a lot of  
12 safety cases say that, yes, we are passing on some degree of  
13 risk to future generations. The waste will always be there  
14 and they will have to deal with it one way or another.

15 When I talk about opening a discussion on storage,  
16 we can talk about maybe a hybrid solution. Utilize Yucca  
17 Mountain or some other place where you actually develop a  
18 hybrid concept for repository storage. But, you don't have  
19 to make the decision to close. Okay? Because the decision  
20 to close is based on this "prediction" that we seem to have  
21 to make that gives everybody heartburn. And, I think that  
22 the uncertainties are what we're really talking about here.

23 So, maybe what we pass on to future generations is  
24 a Yucca Mountain where we turned into a storage facility. We  
25 drain it, we vent it, we watch it. And, we also provide

1 future generations with the option to close it. We can  
2 provide them with our current state of technology, plans, and  
3 maybe even a trust fund to do that. That may be a very  
4 responsible way to go. But, there's a variety of things that  
5 we can do. I just feel like we're trapped into this sort of  
6 final solution and we're really wrestling with this idea of  
7 predicting to long-terms with great uncertainties and lots of  
8 heartburn.

9 DR. BREWER: Bill Magavern and then Steve Kraft.

10 Bill?

11 MR. MAGAVERN: Yeah. I also want to comment on this  
12 generational issue. I don't consider myself a spokesman for  
13 a generation and certainly not an advocate of generational  
14 warfare, but I may be the youngest person on this panel and I  
15 think that it's already clear that the generation that  
16 created the problem is not going to solve it. And, your kids  
17 and your grandkids will be saying you left us a mess.  
18 There's no doubt about that. And, what we're trying to do  
19 now is just to keep that from getting worse than it already  
20 is. And, in the environmental community a lot of people are  
21 very skeptical about the politics that have driven the site  
22 selection process up until now and I think it will only get  
23 worse and it is also reopening the whole question of whether  
24 geologic disposal is the way to go to begin with.

25 DR. BREWER: Steve Kraft?

1           MR. KRAFT: I think that I answered what Bill Magavern  
2 just said earlier in saying about I can easily envision that  
3 you don't have to go to disposal right away, but we need the  
4 capability to do it. Let me just--what I really wanted to  
5 comment on was what Ned said and take it one step further.

6           In the model that we envision--it is possible here  
7 --is that I like the idea about you put in the storage,  
8 perhaps in an underground setting, you don't make the  
9 decision to close because that requires then a belief in the  
10 models and everything else. What you can do is borrow some  
11 concepts from the advanced reactor--and say, okay, here's the  
12 deal. And, you go to Mal and you say I will do the  
13 following. I will put it underground and we'll do what you  
14 said and we'll drain it, we'll watch it, you know,  
15 everything; but at the same time, I will make a commitment in  
16 my license to a series of--let's call them for lack of  
17 anything else, ITACS; you know, things you're going to do  
18 over that 100 year period which, of course, is reviewable in  
19 the future by future generations if we selected the wrong  
20 things that will lead to greater confidence over time to a  
21 closure decision. And, after 100 years, if we still don't  
22 know enough, we'll go another 100 years. But you will have  
23 to make the case to Mal that you can at least pass the 100  
24 year test; whatever that 100 year test happens to be, whether  
25 it's current Part 72 or current something else, some other

1 version of Part 60. So, at least, you've got the confidence  
2 that your licensing something for that 100 years, be it on  
3 the surface or underground. So, I think that that's what you  
4 need as a legacy.

5           Now, you get down--and then, the other point that I  
6 want to respond to is you get down to actually a point of  
7 personal points of view and personal values. Leaving spent  
8 fuel in a responsible manner as an available resource to the  
9 future generations, in my view, is the responsible thing to  
10 do, not the irresponsible thing to do. There are people who  
11 think that's going to be irresponsible. And, sometime in the  
12 future, future generations may discover a use for that  
13 material that we haven't thought of like curing male pattern  
14 baldness or something. I don't know. Whipple and I are  
15 going to patent that process.

16       DR. BREWER: Steve Frishman and then what I want to do  
17 next--we'll let Steve sort of follow--is turn it to my  
18 colleagues on the Board to see if there are some questions  
19 for members of the panel and then to open it up to the public  
20 after that.

21           So, Steve?

22       MR. FRISHMAN: I think the concept of storing  
23 underground at Yucca Mountain, of course, is an interesting  
24 one because in 100 years you're not going to know any more  
25 about the long-term performance of that tunnel system that

1 you have built from a natural barrier side than you're going  
2 to know with a concerted effort up front. Storing  
3 underground in those tunnels would--the promise that you  
4 won't close it until you know more. The only thing you're  
5 going to know more about is whether the engineered barrier  
6 that you've built works in a tunnel full of air. You're not  
7 going to know anything about disposal. And, frankly, I'm  
8 really surprised that you would advocate storing it  
9 underground when that's just totally squandering the waste  
10 form. Why would we want an expensive hole in the ground?

11 DR. BREWER: I don't believe we can leave it there.

12 Steve Kraft and then Ned?

13 MR. KRAFT: I think it--okay, store it above ground, but  
14 the fact of the matter is is that it's not that you're going  
15 to learn that much more about the waste package and air in  
16 the tunnel. Jean and her future generations of people in her  
17 science will get to do 100 years of basic research in geology  
18 and be that much smarter about how geology--

19 MR. FRISHMAN: But, the rock isn't going to change.

20 MR. KRAFT: I'm sorry if I've consigned you to hell for  
21 that, but that's my point. That if you're going to learn,  
22 you're going to develop techniques and learn more.

23 MR. FRISHMAN: The rock isn't going to change, though.

24 MR. KRAFT: To learn more about the rock and more ways  
25 to assess the rock--

1 DR. BREWER: Ned?

2 DR. PATERA: What I was talking has nothing to do with  
3 actually learning more about the rock in 100 years. What it  
4 has to do with is passing on the minimum responsibility to  
5 the next generation, and I believe part of that minimization  
6 of that responsibility is providing the next generation with  
7 choices. And, the choices may be that they decide to  
8 retrieve; the choices may be that they decide to close; the  
9 choices may be that they decide to pass it on to the next  
10 generation. Okay? And, it basically has nothing to do with  
11 learning more about the site itself. It's a minimization of  
12 the responsibility that we pass on to the next generation.

13 DR. BREWER: I think that that's probably a good ending  
14 comment for the panel, as such.

15 I'd like now to offer up to my colleagues on the  
16 Board and staff any questions you have about the discussion,  
17 questions directed in general to specific individuals.  
18 Colleagues?

19 (No response.)

20 DR. BREWER: I can't believe this. You guys always have  
21 questions. Yeah, Don? Yeah, you have to go to the  
22 microphone and say who you are, please?

23 DR. LANGMUIR: I'm a little uncomfortable coming to  
24 specifics from this great general discussion here.

25 DR. BREWER: Well, why don't you get it down to earth

1 and then underground?

2 DR. LANGMUIR: Some questions for Jean Younker. I  
3 thought you did a terrific job of laying out where people  
4 were, where the DOE was going, and what they propose to do.  
5 It left some very titillating issues hanging out there for us  
6 to think about and I hate to be this specific, but Page 27 of  
7 her--

8 DR. BREWER: From the sublime to something else, is that  
9 what's--

10 DR. LANGMUIR: I look at the list here which is a  
11 summary of key uncertainties related to waste isolation and  
12 these are things that we've been talking about in Board  
13 meetings for some time now and we agree this is what they  
14 really are. My sense is from where you are now and where you  
15 might get in the next three years that you'll be saying in  
16 '98, at best, the site has not yet been shown unsuitable.  
17 These are very tough questions to resolve, tough issues to  
18 get answers to. They're going to require more data  
19 collection, presumably surface-based and ESF-based sampling  
20 and analysis and modeling and so on, much of which will never  
21 get accomplished by '98. So, we'll be into the bounding  
22 analysis and the expert judgment realm of things which makes  
23 me very nervous because I don't like to see those as  
24 substitutes for data.

25 I guess, I'd like you to comment on where I've

1 gotten in this discussion?

2 DR. BREWER: Jean Younker, good luck.

3 DR. YOUNKER: Thank you, Garry.

4 I think that those of us who have tried to put the  
5 proposed program approach together which kind of tries to  
6 look at a phased approach to that reduction of uncertainty  
7 that's built against those key points on that page, you know,  
8 all have the same concerns. How far will you be able to  
9 carry it in terms of understanding? You know, I think I  
10 tried to show you in the presentation that we certainly are  
11 going to get a fair amount of new information about kind of  
12 the fundamental site conditions through the excavation of ESF  
13 and through the surface-based program carefully focused, I  
14 think, in the next couple of years. I think that we all have  
15 the sense that with the increased focus on getting the waste  
16 package through Title 1 and big emphasis on the 1,000 year  
17 container--you know, at least, 1,000 year container--being a  
18 key part of the strategy that we're going to spend as much as  
19 can reasonably be allocated on that engineered barrier system  
20 research and development, material corrosion, rate testing,  
21 and the things that need to be done there.

22 So, I have the impression that we'll probably have  
23 more in '98 than what we would have had if we hadn't  
24 overhauled the program with the PPA. Now, I may hear from  
25 Bill Clarke that that isn't the way it looks to him. I'm not

1 sure about that. But, given the focus that we tried to spend  
2 on the importance of the safety in the early period, being  
3 full containment within the waste package, you know, I guess  
4 I have the impression that we've got a lot of people thinking  
5 about how to increase the slope a little bit and the  
6 information you need in order to make that case by the year  
7 2000 in our license application.

8           I can't give you very many facts, Don. I think we  
9 have to turn to the people who are really trying to plan the  
10 details of incremental increases in information in those  
11 areas. You know, Bill Clarke, maybe a quick comment on this,  
12 but I don't know if that, at least in part, responded to your  
13 comment.

14       DR. BREWER: Okay. Bill, did you want to respond or,  
15 Felton, either one?

16       MR. BINGHAM: Yeah, I'd like to point out a naive  
17 expectation. If you look at the total system performance  
18 assessments, it's very clear that the worst uncertainties of  
19 all have to do with the way water moves through the site.  
20 Julie brought up, probably for the ten thousandth time in the  
21 last 10 years, percolation flux is something we've got to  
22 know about. But, the really big one is is the water coming  
23 through uniformly, is it coming through down faults, where is  
24 it? And, I have the optimistic feeling and have for a number  
25 of years that if we could just get underground and walk

1 around and look at the ceiling, is it dripping or isn't it?  
2 We might go a long way toward resolving what I think is  
3 clearly the most basic uncertainty in the total system  
4 performance assessments. It's still a long, long way to go,  
5 of course, but gosh, I would have felt better if we could  
6 have walked around underground 10 years ago.

7 DR. BREWER: Bill, would you have felt better or did you  
8 want to respond here?

9 MR. CLARKE: I'm in enough trouble in DOE already. I'm  
10 not about to touch a budget issue.

11 DR. BREWER: Maybe Chris Whipple will.

12 DR. WHIPPLE: Just to throw in a bit of pessimism here,  
13 I am concerned to hear people associate data with reduction  
14 of uncertainty. I don't know why on earth anything in your  
15 experience would lead you to believe that there's a  
16 correlation there. Certainly, on the WIPP performance  
17 assessment, the data says, damn, the models are wrong. We've  
18 got to start over. But, they do. I mean, you make progress,  
19 but it gets worse before it gets better.

20 The other thing is the environment you're working  
21 in. I mean, if we're lucky, the NAS report on standards will  
22 be out in, maybe, March. If we're lucky, the EPA report will  
23 be out, maybe, two or two and a half years after that and the  
24 NRC report, maybe, two years after that and you'll be in the  
25 year 2000 before you know what the standard is, but you're

1 going to show the sites are suitable two years before you  
2 know what the standard is? I don't see that happening.

3 DR. BREWER: Jean Younker?

4 DR. YOUNKER: I don't have a well thought out response  
5 to what Chris just said, but I do want to bring up one point  
6 that I just think is really back to Felton and Julie's  
7 observation that the spatial distribution of flux passing  
8 through the system is really a key variable no matter how you  
9 look at this site. One of the things we asked for and I  
10 don't know for sure if I'm really supposed to be sharing this  
11 with everyone, but since it seems like an appropriate thing  
12 to do, I'm going to do it. We asked Ed Quickless--if you  
13 remember in your last--I think it was in your last Board  
14 meeting, Dick Luckey told you about what he thought the  
15 saturated zone studies could and could not bring to technical  
16 site suitability and this was in the last Board meeting.  
17 Well, Ed Quickless, who has a really good feel, I think, for  
18 what the unsaturated zone studies will be doing, gave us a  
19 similar list for the unsaturated zone studies and what they  
20 would bring to technical site suitability and it addresses  
21 what Felton said so well. I just want to read you one of the  
22 bullets on his chart. "Identification of the dominant  
23 hydrogeologic controls on the UZ hydrologic system including  
24 assessment of the hydrologic significance of fractures,  
25 faults, capillary barriers, and perched-water." Then,

1 there's another one that talks about an understanding of the  
2 spatial distribution of infiltration. So, you know--

3 DR. BREWER: Is that like the roof leaks? Is that what  
4 fits?

5 DR. YOUNKER: I think something like that.

6 DR. BREWER: Okay.

7 DR. YOUNKER: I mean, I see some--I'm looking down into  
8 the PIs and the project and looking at what they're telling  
9 me. They think they'll have some understanding of it, and  
10 they are some of the most sensitive variables we see in the  
11 performance assessments that we do. So, on the other hand, I  
12 also understand Chris' point that, boy, when you first start  
13 giving us some information of a new kind or from a new  
14 source, you generally find out that some of what you thought  
15 before just isn't the way it is and, you know, your air bars  
16 go up rather than close in. So, that's a fact that we're  
17 going to have to deal with.

18 DR. BREWER: Okay. Steve Brocoum to follow and then I'm  
19 going to go back to my colleagues and then the audience.

20 DR. BROCOUM: That's an interesting discussion that was  
21 started by the question Don Langmuir asked. And, I guess,  
22 the heart, can we characterize a site and can we characterize  
23 it for the amount of money that Congress is willing to give  
24 to us? A lot of things we're hearing here is, well, we're  
25 not even going to have a standard in place by the year 2000.

1 Why are you guys saying, hey, you're going to make a license  
2 application? I think--and, if Dan was here, he may make some  
3 comment; Dan Dreyfus. He did say something this morning that  
4 we don't have all that much time to demonstrate real  
5 progress. That's one of the questions we have to ask in a  
6 philosophical sense is if we can't characterize a site, the  
7 regulations require us to disqualify it. And, in a sense,  
8 "can characterize" can be defined different ways. If you  
9 can't do it under the budgets in the number of years that  
10 society through Congress are willing to give us, we may  
11 disqualify the site.

12           The other point I want to make is disqualifying the  
13 site itself is a very weighty decision because what we're  
14 doing in a sense is we're disqualifying the site very early  
15 in the whole process of studying it, licensing it,  
16 constructing it, and confirming it which is, say, 50 years or  
17 100 years. And, you'll have a lot more information after 50  
18 years or 100 years to decide you should close it or monitor  
19 it forever or whatever you may decide to do at that time.  
20 But, if we disqualify the site for whatever reason because we  
21 can't afford it or we don't have enough time or Congress gets  
22 tired, then we're in a sense, de facto probably, saying  
23 geologic disposal will not work in this country at this time  
24 because it's unlikely we're going to get another site. I  
25 just wanted to just make that point.

1 DR. BREWER: That's a good point; an excellent point.

2 Any of my colleagues on the Board have other  
3 questions/comments? Dennis Price?

4 DR. PRICE: Just a quick one. I think the only member  
5 on your roundtable who hasn't spoken is our foreign  
6 representative and I'm wondering what he thinks of all this  
7 stuff.

8 DR. BREWER: And, first of all, before we go to J. Van  
9 Miegroet, my apologies. I was trying my best to include  
10 everyone and I didn't.

11 What do you think of all this stuff?

12 DR. VAN MIEGROET: I don't know what to think.

13 DR. BREWER: He's puzzled.

14 DR. VAN MIEGROET: I still feel that it's a hopeless  
15 task to compensate the lack of credibility of the geological  
16 medium by--and the type of engineering development. I don't  
17 see--with all respect that I have to all Swedish colleagues,  
18 I don't see how you can convince, at least in my country--how  
19 you can convince the population in general and even the  
20 scientists who at some point will have presented the  
21 population and those scientific commissions that you have to  
22 deal with--I don't see how you are capable of convincing  
23 those people because it's--well, you can indeed from the  
24 chemical standpoint--you can indeed make nice demonstration  
25 that your canister will last for one million years, but can

1 they still--material, they have weldings, they've been  
2 formed. So, you're just--well, for me, just undemonstrable,  
3 this type of thing. So, either the geology is good, good  
4 enough, or it is not.

5 DR. BREWER: Certainly, one of the extreme points of  
6 view and quite consistent with what Belgium seems to be  
7 doing.

8 DR. VAN MIEGROET: I also want to say that nothing is  
9 black and white.

10 DR. BREWER: Yes.

11 DR. VAN MIEGROET: So, when I say and I repeat it, in  
12 all cases, we are not really giving to the engineered barrier  
13 more than the role of limiting or preventing the amount of  
14 disturbance. When this engineered barrier which has that as  
15 main role is there, we are taking some advantage of it to, if  
16 possible, use it for some aspects of additional protection.  
17 I mentioned, I think, the possibility of having some--in the  
18 Bentonite layer to limit the iodine migration that at the  
19 moment it's not quite satisfactory in the layer. Well, there  
20 are some such things. But, the real trust is not there.

21 DR. BREWER: Yes. Thank you very much.

22 I think it's time to open this up to questions from  
23 the audience. And, if there are questions, please go to one  
24 of the microphones and identify yourself and so on, please.  
25 We need to know who you are and if you represent something or

1 someone besides yourself.

2 DR. MCGUIRE: My name is Robin McGuire. I'm a  
3 consultant for EPRI. I'd like to try to tie together three  
4 things that I heard this afternoon. One was the statement by  
5 Steve Kraft that we ought to look at the effects--go past  
6 Point B on that one diagram to Point C which would be the  
7 effects on the population including some measure of the  
8 biosphere which I support. The second was the statement from  
9 the gentleman--I apologize for not remembering your name--who  
10 said that we can design these engineered barrier systems to  
11 be damn strong and last for a hell of a long time. The third  
12 was a statement, one of Chris Whipple's four points on what  
13 you use an EBS for and that specific point was to control the  
14 rate of release. What I'd like to point out is if we design  
15 these EBSs to be damn strong under one environment, there may  
16 come along at some point in time, maybe it's 90,000 years or  
17 150,000 years from now, a different environment and that may  
18 cause them to all fail at all, more or less, the same time.  
19 That may be in this case a flood environment which has  
20 perhaps a minuscule probability of occurring, but not a zero  
21 probability of occurring. The result will be a large dose, a  
22 large release, and consequently a large dose to the  
23 population. It may be--and, my interpretation of Chris  
24 Whipple's point is that we may be in a better position  
25 designing an engineered barrier system to fail over a period

1 of time, a long period of time, releasing very small amounts  
2 each year or each decade or each 1,000 years than trying to  
3 make it massive and robust and making it possibly potentially  
4 subject to catastrophic failure over a short period of time  
5 with potential consequences on future population at that  
6 time.

7           I guess my question would be is that what you  
8 meant, Chris, by your point?

9           DR. BREWER: Chris Whipple?

10          DR. WHIPPLE: Yeah. Robin, it's not what I meant, but  
11 it may not be an awful thing if it happened. No, what I  
12 meant is I think that we--for example, we saw on the slide  
13 the Swedish cask. It's got two layers. We might make a two  
14 layer cask that one layer is for the present environment as  
15 we understand it and the second is a belt and suspenders that  
16 gives us some coverage against a second layer. And, I guess,  
17 I just--I think, first, pushing releases further out in time  
18 and controlling them, for example, with air spaces around the  
19 canisters and so forth, are things that can release the rate.  
20 I don't think trying to engineer a time release waste  
21 repository is a very good idea. I think that's what you  
22 describe.

23          No, again, to pick on the program which is my role  
24 in life, to see that two different conventional alloys are  
25 proposed for the waste package says, you know, we're not

1 trying hard enough. Well, you know, have you really looked  
2 at ceramics and titanium and so on? This isn't my field, but  
3 from what I understand, you know, for some increment of  
4 effort, you might get a waste can that's just as happy as a  
5 clam down there in whatever place you park it.

6 DR. BREWER: Clams like water.

7 DR. WHIPPLE: It will be humid there. That is what I  
8 had in mind; more of a smarter, higher tech approach.

9 DR. BREWER: Good. Thank you very much.

10 Anyone else from the audience have questions or  
11 comments? Your name and identification, please?

12 MS. TREICHEL: Judy Treichel, Nevada Nuclear Waste Task  
13 Force.

14 I see a real contradiction or a real dilemma here.  
15 It would seem to me with a project as important as this one  
16 is and with the sort of potential for--we always hear the  
17 word "catastrophic" or the kinds of results that could happen  
18 throughout the life of this project that could have such  
19 severe effects on the population that you would almost need  
20 to be assured that the population was behind this effort.  
21 And, we have very good reason to believe that it's not. We  
22 know that the population of Nevada doesn't support the effort  
23 and I know that Bill Magavern would be able to respond to  
24 this about what the public in general thinks about this  
25 because his organization deals with a whole lot of the public

1 and he deals with other national organizations that do. But,  
2 we're continually being told that you can't have an  
3 independent review or you can't stop now and go back and re-  
4 examine whether or not there should be geologic disposal or  
5 you can't take the time to really examine this, and yet we're  
6 also told that public confidence is a very important element  
7 in this thing. Well, you don't have public confidence and  
8 you're expecting a whole lot of it not just from Nevada  
9 where, as Steve Kraft says, here it comes, but from people in  
10 a whole bunch of states that are going to have to see this  
11 stuff go by and believe that it's not going to kill them  
12 while it's doing that. So, you really require a lot of  
13 public confidence if, in fact, you think that's important.  
14 And, I think we need to determine if that's a real important  
15 thing.

16           And, when you're talking about the sorts of time  
17 periods, you know, that are just out of the realm of people's  
18 understanding, but yet on the other hand, we don't have time  
19 to take a look at the thing and see if it's really what we  
20 want to do, there's sort of a disconnect here. But, I know I  
21 get--I'm on the phone all day long with national groups,  
22 regional groups, individuals from Nevada and elsewhere, and  
23 there's everything from skepticism to real anger. And, I  
24 wouldn't want to be in the position of some of the people up  
25 at the table there where you're accused of being just

1 outlandishly arrogant to take it upon yourself to make these  
2 sorts of decisions without checking with the public or having  
3 a kind of a national examination of this thing. I certainly  
4 know you're not arrogant. I know all of you and I know how  
5 great you are. But, there is that feeling out there that  
6 there's some people making awfully important decisions and  
7 they shouldn't be. And, the time, if you're talking about a  
8 year or two or three or whatever, the worst case scenario on  
9 a review of the program isn't going to make a whole lot of  
10 difference when you're talking about the kind of time periods  
11 that you do.

12 DR. BREWER: Good. Thank you, Judy.

13 You had offered a lead to Bill Magavern. Would you  
14 like to follow up on that a bit?

15 MR. MAGAVERN: Well, just you don't have to take my word  
16 for it. Listen to what DOE says about the trust in DOE.  
17 Hazel O'Leary has said that there's less trust in DOE than  
18 almost any other institution in the country based on their  
19 surveys. I think it was lower even than Congress and the  
20 media, if you could believe that.

21 In terms of an independent review, certainly my  
22 organization, many other public interest groups, many members  
23 of Congress, the GAO, a lot of different entities have called  
24 for some form of independent review of the program and DOE  
25 has still not undertaken one and I don't think has given a

1 persuasive reason not to have one.

2 DR. BREWER: Okay. Thank you.

3 Any other questions from the audience? Name and  
4 institution, please?

5 MR. WILLIAMS: I'm Bob Williams and I'm recently  
6 retired. I have developed a new avocation in retirement.  
7 Instead of squandering my money going to Super Bowl games and  
8 football games, I've decided to attend meetings of the  
9 Nuclear Waste Technical Review Board. I say that with some  
10 light-heartedness because in my 20 years of watching this  
11 program, this is perhaps the best informed discussion of the  
12 role of the engineered barrier system that I've seen. My  
13 compliments to you and the staff and the organizers.

14 At the same time, I'm appalled. I think there will  
15 be plenty of sport for me in the next 10 or 15 years because  
16 I see hardly any movement to introduce this into the system  
17 in a way that the system can capture it and move forward.  
18 So, I would pose that to you as a challenge for your next  
19 annual report or whatever. How do you capture the substance  
20 of what has been said here and move ahead with it because  
21 many of the same thoughts have been rattling about for the  
22 last 10 years.

23 DR. BREWER: Well, I can speak for myself and other  
24 colleagues on the Board can do as well. I mean, we had  
25 lengthy discussions and considerations about this very

1 subject. The setup of the meeting and the format and  
2 everything else was really designed to elicit conversation of  
3 the sort that I think we've had. And, where we go from here,  
4 I mean, we do what we can do.

5           Would our chairman like to comment on this  
6 particularly personal reaction? John?

7       DR. CANTLON: It's always my pleasure essentially to  
8 give you the sign off. I'm usually blessed by being brief.  
9 I think I want to thank all of the participants. I would  
10 agree with the last speaker's statement that we do get some  
11 informed discussions across a much broader spectrum of people  
12 and one of the things that has always impressed us is that  
13 the level of interchange between the people who are actually  
14 involved in the process sometimes is improved in these kinds  
15 of discussions. So, we hope that rubs off on the program.

16           So, on behalf of the Board, let me thank all of the  
17 participants and the attendees here. We thank you.

18           We're now adjourned.

19           (Whereupon, at 5:25 p.m., the meeting was adjourned.)

20

21

22

23

24

25

1

2

3

4

5

6

7

8 ; ;