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Meeting Title: Brief by Nuclear Waste Technical Review Board (NWTRB)

Meeting Date: 3/14/94 Open X Closed _____

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Title: BRIEFING BY NUCLEAR WASTE TECHNICAL REVIEW BOARD
(NWTRB)

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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BRIEFING BY NUCLEAR WASTE
TECHNICAL REVIEW BOARD (NWTRB)

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PUBLIC MEETING

Nuclear Regulatory Commission
One White Flint North
Rockville, Maryland

Monday, March 14, 1994

The Commission met in open session,
pursuant to notice, at 2:03 p.m., Ivan Selin,
Chairman, presiding.

COMMISSIONERS PRESENT:

IVAN SELIN, Chairman of the Commission
KENNETH C. ROGERS, Commissioner
FORREST J. REMICK, Commissioner

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STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

WILLIAM C. PARLER, General Counsel

JOHN HOYLE, Assistant Secretary

DR. JOHN E. CANTLON, Chairman, NWTRB

DR. D. WARNER NORTH, NWTRB

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

2:03 p.m.

CHAIRMAN SELIN: Good afternoon, ladies and gentlemen.

This afternoon the Commission is pleased to welcome John Cantlon and D. Warner North from the Nuclear Waste Technical Review Board to brief the Commission on the status of their activities.

Doctor Cantlon, Doctor North, we're very pleased to have you here.

The safe and secure long-term disposition of high-level nuclear waste is, of course, an important challenge confronting the federal government and the industry. In fact, many think it's one of the half dozen or so largest environmental challenges in the country. Congress considers the timely resolution of the issue a top priority and it has given this responsibility to the Department of Energy. The Department's recent efforts have been to look at ways to expedite its progress. As an independent board created by Congress, you have the unique role in this national effort to resolve the nuclear waste problem and, in our modest opinion, you're performing a special and really quite impressive service.

The Commission also has a role. We are

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1 to, at the beginning, try to identify key issues that
2 have to be solved and eventually be called on to
3 license the facility or not to license the facility.
4 So, we're very interested in receiving your briefing
5 on the status of the Board's activities and the state
6 of the DOE Civilian Radioactive Waste Management
7 Program.

8 Apart from the major licensing questions,
9 we also have the question of allocation of our
10 resources. So, even managerial and questions of rate
11 and progress are also important to us.

12 So, Doctor Cantlon, without any further
13 adieu, we look forward to hear what you and Doctor
14 North may have to tell us today.

15 DOCTOR CANTLON: Well, thank you, Mr.
16 Chairman, members of the Commission.

17 (Slide) It's a pleasure for us to be here
18 today. As you've noted, my name is John Cantlon. I'm
19 Chairman of the Nuclear Waste Technical Review Board
20 and accompanying me here is Doctor Warner North, a
21 member of the Board.

22 About a year ago we talked to you about
23 the Board and its perspective on the Department of
24 Energy's program to manage civilian spent fuel and
25 defense high-level waste. Today we'd like to update

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1 you on progress during the past year and on the
2 Board's views regarding some of the key decisions that
3 we expect the DOE to be facing during the coming year.
4 Then we'll provide some observation on NRC's role in
5 the effort and we'll close our remarks with a brief
6 synopsis of the Board's latest report to Congress and
7 the Secretary of Energy.

8 (Slide) The Board, as you know, was
9 created by Congress in '87. The Nuclear Waste Policy
10 Amendments Act was the device and is charged with
11 evaluating the technical and scientific aspects of the
12 waste management program. This includes site
13 characterization activities and activities relating to
14 the packaging and transport of high-level radioactive
15 waste and spent fuel.

16 As you're also aware, the Board is an
17 independent agency with the federal government, not a
18 Department of Energy or any other regulatory agency.

19 (Slide) Members of our Board are
20 nominated by the National Academy of Science and are
21 appointed by the President. I have served on the
22 Board from its creation and became its chairman two
23 years ago. Currently ten of the Board's
24 eleven memberships are filled and I've listed in the
25 overhead there the members for you. We all serve

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1 part-time. The Board is organized into seven panels.
2 They're shown in the next viewgraph.

3 (Slide) Since the Board's inception and
4 especially during the last year, the Board has
5 witnessed considerable progress in the Civilian High
6 Level Waste Management Program. For example, after
7 several delays, construction of the underground
8 excavation of the exploratory studies facility at the
9 mountain has been started. Also, the management and
10 operating contractor is beginning to integrate the
11 program and its various components, storage,
12 transportation and disposal. The Board strongly
13 believes that the momentum of these activities should
14 be maintained.

15 The coming year promises to be one of
16 additional progress. Also one during which many
17 important decisions will be made. Some of these
18 decisions are the direct responsibility of DOE. An
19 example is the decision whether to pursue the
20 development of a multi-purpose canister design. Other
21 decisions will involve interactions with other bodies,
22 especially the Nuclear Regulatory Commission.

23 Here, an example would be decisions
24 whether to amend the siting guidelines, 10 CFR Part
25 960. Still other decisions, for example regarding the

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1 Administration's proposal to Congress for dispersing
2 of the Nuclear Waste Fund receipts, will not be made,
3 that decision obviously, by the DOE but by the
4 Congress.

5 The Board has been encouraged by Secretary
6 O'Leary's recent efforts to improve the program. For
7 example, she's created the position of Chief Scientist
8 and is proceeding with a financial and management
9 review of the Yucca Mountain project. She's taken
10 steps towards broadening the stakeholder participation
11 in the program and on October 7th, Doctor Daniel
12 Dreyfus was confirmed as Director of the Office of
13 Civilian Radioactive Waste Management, all I think
14 desirable events.

15 At our Board's January 1994 meeting,
16 Doctor Dreyfus listed several short-term goals the
17 OCRWM program had set for itself. These included
18 returning the emphasis of the repository program to
19 science and site characterization, institutionalizing
20 stakeholder interaction and proposing a new funding
21 mechanism to increase the monies that would be
22 available to the program.

23 To achieve this latter goal, the DOE
24 recently requested the creation of a special fund to
25 give OCRWM increased access to the revenues coming

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1 into the fund. In the Board's view, relatively too
2 little funding has actually been going into the direct
3 cost of scientific research and engineering activities
4 that are essential to characterizing the Yucca
5 Mountain site and to laying a sound basis for the
6 waste management system. Based on its four year
7 review of the program, the Board believes that simply
8 increasing the program's funding might not ensure that
9 adequate funds will be allocated to the most important
10 site characterization activities, or even to other
11 critical research.

12 In a February 1994 letter to Congress and
13 to the Secretary, the Board repeated its earlier
14 recommendations for an independent review of the OCRWM
15 management and organizational structure to be
16 initiated as soon as possible. The Board believes
17 that this review can and should be undertaken without
18 slowing the momentum of the important site
19 characterization activities currently underway at
20 Yucca Mountain. Whether the program budget remains
21 level or is increased, program management should
22 ensure sufficient and reliable funding for site
23 characterization, performance assessment and system
24 studies which are critical for integrating the
25 program.

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1 (Slide) The Board believes that the
2 management of spent fuel and high-level waste, that is
3 the transport, storage and disposal of waste, should
4 be viewed as a system whose separate elements and
5 subelements are highly interdependent. The Board has
6 been concerned that DOE decisions about some
7 components of the overall waste management system
8 being made without adequate regard for the effects of
9 those decisions and those could have impacts then on
10 other components or on the entire system.

11 In our presentation to you last year, we
12 discussed the Board's views on several of the major
13 issues facing the program at that time. Today I'd
14 like to update you on the Board's views on two of
15 those subjects, development of a multi-purpose
16 canister and research on engineered barriers. Then
17 I'd like to summarize the conclusions and
18 recommendations of a recent Board report on
19 underground exploration and testing at Yucca Mountain.
20 Finally, I'll close my remarks with some observations
21 about the NRC's regulations for a high-level waste
22 repository.

23 (Slide) First, the DOE is now examining
24 the feasibility of a concept it calls the multi-
25 purpose canister. This concept involves permanently

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1 sealing spent fuel in a canister at the reactor where
2 the spent fuel is generated. During all subsequent
3 storage, transportation and disposal operations, spent
4 fuel would remain sealed within the MPC. If
5 necessary, overpacks or casks would be used for
6 shielding and protection during storage or
7 transportation or to provide corrosion resistance
8 after disposal. This is not simply a storage-related
9 decision.

10 Development of an MPC has potential
11 ramifications for a decision about the thermal loading
12 of the repository, and the thermal loading decision in
13 turn will affect how much waste can be put into one
14 repository; how the waste will be loaded into the
15 canisters; how long the waste must be aged prior to
16 disposal; how the waste is packaged, handled,
17 transported and emplaced in the repository; and how
18 and when the drifts are backfilled. It also will
19 affect how much the overall waste management program
20 will cost. Therefore, the MPC development decisions,
21 as well as the decision about thermal loading, should
22 be approached carefully, especially since future
23 underground thermal tests will be required to support
24 a thermal-loading decision.

25 The DOE has evaluated alternative MPC

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1 designs and has studied the effects of those designs
2 on the rest of the waste management system. In
3 general, large MPC designs offer economic advantages,
4 but often affect other parts of the waste management
5 system such as the repository design. The Board
6 believes that a systems analysis is an important
7 prerequisite to the final design of an MPC. Such an
8 analysis, which does not require a large-scale effort,
9 should assess the tradeoffs of alternative concepts
10 for major parts of the system, storage,
11 transportation, and disposal, and provide a technical
12 basis for decision making. Given the uncertainties
13 associated with disposal, for example what is the
14 thermal loading to be of the repository, the question
15 of how a true multi-purpose canister can be made a
16 reality is a difficult one. Nonetheless, an attempt
17 at least should be made to address this issue in a
18 substantive way given present technology and what is
19 known about the repository and the site.

20 (Slide) A second issue that concerns the
21 Board is the low priority that DOE has placed on
22 studies of engineered barriers. A well-designed
23 system of engineered barriers working together with
24 well-characterized geologic barriers, will increase
25 our confidence in the long-term performance of a

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1 repository. For this reason, the Board has
2 recommended that the DOE place greater emphasis on the
3 engineered barrier system as a way to build redundant
4 radionuclide containment into the repository design.
5 This redundancy, in our view, should help to add
6 confidence about the repository safety, especially in
7 the face of inevitable uncertainties associated with
8 predicting natural geologic, hydrologic and
9 climatological consequences far into the future.

10 CHAIRMAN SELIN: But this wouldn't -- just
11 to make it clear, this would not be a substitute for
12 less work on seismology or geology or any such. It
13 says put the best engineering together with the best
14 science that you can --

15 DOCTOR CANTLON: Right. Yes. We believe
16 so.

17 (Slide) With respect to designing the
18 waste package itself, the Board believes that
19 extensive materials testing is required. Of greatest
20 importance is determining how various materials will
21 hold up over long periods of time under the possible
22 underground conditions. Despite this strong and
23 repeated Board position, the Board has until very
24 recently chosen to reduce the funds going into the
25 waste package development program. We believe that

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1 this is unwise to defer studies in this area. As the
2 DOE reviews its budget priorities during the coming
3 year, the Board recommends that increased funding be
4 directed to the engineered barrier development.

5 In October of last year, the Board
6 published a report entitled, "Underground Exploration
7 and Testing at Yucca Mountain." In that report, the
8 Board expressed its strong support for the DOE's plan
9 to rapidly construct an underground tunnel, to
10 identify and provide access to potentially significant
11 geologic features of the Yucca Mountain site. It has
12 long been the Board's view that the significance of
13 some geologic features, especially those that are
14 nearly vertical, cannot adequately be evaluated using
15 surface-based drilling. This is because there is only
16 a small likelihood that vertical bore holes drilled
17 from the surface will intersect such structures at
18 repository depth. A bored tunnel, however, would
19 cross such features perpendicularly, allowing physical
20 access to them for visual examination and scientific
21 testing at the repository level.

22 The Board also recommended that the DOE
23 should reinitiate its underground thermal testing
24 program as soon as possible to allow the development
25 of instrumentation and procedures to gain as much

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1 testing experience as possible prior to initiating
2 testing in the core test area. The Fran Ridge large
3 block heater test is a start, but the program
4 currently lacks sufficient field testing experience,
5 proven instrumentation for underground testing, and a
6 well developed testing strategy. As I noted earlier,
7 a significant issue currently facing the Yucca
8 Mountain project, is a research base for determining
9 the most appropriate thermal loading for the
10 repository. A well-developed program of thermal
11 testing is needed to support a thermal-loading
12 decision.

13 The Board found that the lack of a testing
14 strategy was also evident in other areas of proposed
15 underground testing. The Board recommended that
16 existing plans should be expanded to produce a
17 comprehensive strategy for exploration and testing.
18 Priorities and goals should be based on specific
19 intermediate goals, should be consistent with
20 scientific needs of the site characterization and
21 repository design, and should be consistent with
22 realistic funding expectations.

23 Finally, the Board found that the DOE's
24 plans for construction of the exploratory studies
25 facility are not consistent with practices in

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1 underground construction industries. The Board
2 recommended development of a more efficient system for
3 managing design and construction of the facility that
4 contains larger accountability and incentives for
5 cost-effective and timely performance by the
6 contractors.

7 Let me now briefly discuss an issue more
8 directly of concern to the NRC, the NRC's regulatory
9 requirements for the Yucca Mountain repository.

10 (Slide) The Board is aware that the
11 Energy Policy Act of 1992 calls for a general review
12 of the repository regulatory requirements, including
13 those of the NRC. However, any needed amendments to
14 the NRC's regulations are to follow completion of the
15 reviews by the National Academy of Sciences and the
16 Environmental Protection Agency. Several years could
17 be required to complete those reviews. Meanwhile, the
18 repository program is having difficulty implementing
19 certain aspects of the NRC's regulations and some NRC
20 criteria may actually be unnecessary for repository
21 safety.

22 The most obvious example is the ground-
23 water travel time criterion, 60.113. The DOE is now
24 conducting studies to estimate groundwater travel time
25 even though many hydrologists do not believe that it

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1 is a very meaningful indicator of the suitability of
2 the site. At Yucca Mountain, other parameters, such
3 as percolation, flux through the unsaturated zone,
4 might be better measures of the waste isolation
5 capabilities of the site.

6 Another example of less immediate urgency,
7 but possibly of greater significance as the repository
8 design matures, is the provision in Part 60.113 that
9 allows alternative numerical goals for the performance
10 of the major subsystems of a repository. It is not
11 clear at what stage in the licensing process the NRC
12 would approve or specify alternative goals, nor is it
13 clear how the NRC would decide what those goals should
14 be.

15 It has been more than ten years since
16 NRC's regulations were promulgated. In those areas
17 where there are known problems with the regulation,
18 the Board encourages the NRC to develop needed
19 guidance or amendments now rather than waiting until
20 completion of the reviews of the National Academy of
21 Sciences and the Environmental Protection Agency are
22 through.

23 In summary, the Board expects a number of
24 important decisions to be made, at least in a
25 preliminary way, in the year ahead. These decisions

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1 have the potential to significantly move the program
2 forward. In some cases, the Board has reservations
3 about the adequacy of existing information to support
4 the decisions and review of this information base will
5 be a significant area of investigation by the Board
6 during the coming year.

7 Doctor North and I would be happy to try
8 to respond to questions.

9 CHAIRMAN SELIN: We have a lot of them
10 just because you cover such interesting material. Let
11 me start with a couple of fairly small ones and then
12 get broader and broader.

13 The first has to do with the rule. The
14 staff is very sympathetic to the position that you put
15 up on groundwater and, in fact, is reviewing our
16 position on that. In fact, they come to the opinion
17 that we shouldn't wait for an EPA standard, et cetera,
18 we ought to get going.

19 More broadly, we are working with our
20 contractor to take a full look at the regulatory
21 environment to see other inconsistencies or places
22 that have to be updated. Do you have other examples
23 where you see our regulations causing problems without
24 contributing to safety?

25 DOCTOR CANTLON: We could certainly put a

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1 little thought rather than trying off the top of --

2 CHAIRMAN SELIN: That would be very
3 helpful.

4 DOCTOR NORTH: I think a point we might
5 make to you is given that the repository concept is
6 evolving substantially from what was in the site
7 characterization plan and the basis for the 104 study
8 plans at that time, we need a sense of strategy, how
9 DOE should be collecting information in the process of
10 its license application given that the site is found
11 suitable, and what NRC's priorities are in terms of
12 what information they feel is most important to have.
13 We feel, for example, that the thermal loading issue
14 is quite critical and that much more should be done
15 than is set forth in the study plans and the SCP when
16 the recognition of the importance of that issue was
17 not as strong as it is now.

18 This past week we have had meetings of
19 panels from our Board dealing with the seismic issue
20 and the volcanism issue. With respect to volcanism,
21 we were very encouraged by the state of DOE's planning
22 and performance assessment and by the interaction
23 between the DOE program and the criticism from NRC.
24 It would appear that the discussion is focusing and a
25 lot of issues are getting, I would say, well

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1 ventilated, if not actually forming a consensus.

2 On the seismic issue, however, we were
3 quite disappointed. We felt that DOE was a long way
4 from having an integrated picture and the importance
5 of that issue for near-term decisions on potential
6 repository design wasn't being adequately recognized.
7 This would appear to be an area where both NRC and DOE
8 might be moving more aggressively to determine what
9 information do you really need and how can that be
10 provided soon rather than waiting until the license
11 application period.

12 CHAIRMAN SELIN: Well, let me just
13 comment. First of all, strategies is to us as prose
14 is to Voltaire's character. We may have been speaking
15 it all our lives, but we never recognized it. DOE is
16 supposed to do strategy, we're supposed to respond.

17 On the other hand, we are supposed to be
18 looking at specific plans for show stoppers, in
19 particular, far in advance. You are probably in the
20 best position to look at the two at the same time.
21 We're aware basically of volcanism, seismicity and
22 probably the thermal load is the three major areas
23 that have to really be settled or at least illuminated
24 before a great deal of progress, but we can only
25 respond to the plans that say, "If you do what you're

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1 planning to do, we have doubts that you will be able
2 to answer the question." We can't go back and say,
3 "You should be doing it differently or some other
4 fashion."

5 However, having said all that, we are
6 trying to guess ahead of time where the major issues
7 will be, how to respond, to in effect have regulations
8 that are both robust and relevant. Your insights on
9 those would be useful. I appreciate the talk about
10 strategy, but if you could get down to nuts and bolts,
11 that would be even more useful.

12 The second question I wanted to ask you
13 about had to do with the multi-purpose canister. It's
14 pretty easy to see the advantages and the lack of
15 disadvantages having the same canister for both
16 storage and transport. But when you get to disposal,
17 it seems to be at least the possibility that there be
18 some major tradeoffs or major questions given up in
19 the attempt to be able to do the same canister. Do
20 you have some feelings on that?

21 DOCTOR CANTLON: Yes. We're very much
22 concerned about that and have had some conversations
23 with the DOE on the issue. Obviously if you make a
24 choice to go with a large robust canister and in-drift
25 emplacement, which has many desirable features,

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1 economically and handling and safety and protection
2 from seismic issues and so on. On the other hand, if
3 it's clear that you cannot retain the radionuclide
4 retention qualities of the rock at a high thermal
5 load, if that degenerates based on experiments and now
6 these require fairly lengthy experiments in order to
7 confirm that, then making this early decision on the
8 size will have to be undone. DOE has done some very
9 good thinking about this at a sort of first order
10 level. They're quite aware that they're taking a risk
11 in moving ahead. Obviously, they're driven by the
12 1998 commitment that they've made to the utilities for
13 beginning the fuel acceptance, which then drives a
14 decision which really ought, in the best of all
15 worlds, to be based on solid scientific and technical
16 assessments of the rock.

17 Of course, because they were delayed in
18 getting underground at least a year by the way they
19 proceeded, even getting the thermal experiment started
20 down in place there and getting the corrosion
21 experiment started in place so that the data will be
22 acceptable to you people, that it's relevant because
23 it really characterizes the conditions under which
24 those things will be retained, has in a sense
25 necessitated then DOE to take a substantial risk.

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1 CHAIRMAN SELIN: Well, to follow-up on
2 these, since your charge is beyond just a repository
3 in this, the whole question of the waste questions,
4 are you proposing to take a look at the advisability
5 of that tradeoff? I mean I could see where trying to
6 do too many things with one system might actually lead
7 to slowdown rather than progress.

8 DOCTOR CANTLON: Well, yes, we are. We
9 are and have been looking at that issue and have had
10 some candid discussions. I would say that DOE
11 acknowledges what we're saying. They have essentially
12 made a decision to incur that level of risk in order
13 to meet the pressure of the utilities. Now, the cost
14 of making --

15 CHAIRMAN SELIN: I don't really understand
16 that. If it were just to meet the pressure of the
17 utilities, they'd be better off with a dual purpose
18 canister that could do storage and retrieval and just
19 not worry about eventual --

20 DOCTOR CANTLON: Well, that's basically
21 what they're ending up with, of course. Our question
22 is is that dual purpose canister going to be designed
23 with enough knowledge so that it is really compatible
24 with adding particular kinds of jackets? Well, that's
25 one issue. But the other issue then is the size, the

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1 starting size. If you wanted essentially to have all
2 bases covered, you could end up with some kind of a
3 canister that could be aggregated together into a
4 large canister, but that's a very tough design
5 question and so on.

6 So, we don't know yet what the response of
7 the bidders will be to the draft RFP that DOE has put
8 out and we will be looking at those later on. Some of
9 the early drafts that we've seen virtually were silent
10 on the repository end of things. So, hopefully, that
11 will get addressed in a little bit more detail and it
12 will be thought through. Whether or not a cost
13 effective design can cover all the bases or not is --
14 you know, that's a good, tough engineering question.

15 CHAIRMAN SELIN: I have some broader
16 questions, but I'd prefer to allow my colleagues to
17 follow-up on these direct things and then come back to
18 these.

19 Commissioner Rogers?

20 COMMISSIONER ROGERS: Well, yes. There's
21 sort of a collection of little things that are
22 specific and some more general things.

23 I think you have said some words about the
24 SCP. The question is to what extent do you believe
25 that the SCP is really binding the NRC to, in a sense,

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1 an outmoded approach to looking at all the issues? A
2 lot has changed since the SCP was first issued and the
3 design concepts and different priorities have changed.
4 To what extent do you think that the SCP itself needs
5 an overhaul?

6 DOCTOR CANTLON: Well, we have certainly
7 kicked that issue around in the Board. There's no
8 question but what doing a full SCP overhaul would be
9 very costly and even delaying problem for DOE. I
10 think that not much good would come from it other than
11 a fairly substantial delay in the program because that
12 is not a simple undertaking. On the other hand, I
13 think your question about whether or not the old SCP
14 isn't in a sense a kind of binder and a delaying
15 factor, that's a difficult question to answer
16 rigorously. But we do know that we listen to
17 presentations in which the simulations are based on
18 the site characterization plan model when everybody
19 knows that major features have long since gone away.
20 So, the tail end of that original plan is still out
21 there grinding data sets away. So, it is really
22 imposing some undetermined level of burden on a
23 system. We haven't done any quantitative look at
24 that.

25 Now, when we've discussed candidly with

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1 the program managers at various levels, they've said,
2 "Well, we've been doing a more or less continuous
3 change process." So, at the level of the home office,
4 we no longer have the original site characterization
5 plan, we have this changed model. So, at least at our
6 conceptional level, we're no longer wedded to where we
7 started because the program has learned a great, great
8 deal. Indeed, we just left testimony on budgeting and
9 Congress is very upset because all they see is a
10 product of their multi-billion dollar investment is a
11 200 foot hole in the mountain.

12 Well, to be honest and to give DOE credit,
13 there is an enormous amount of information that has
14 been compiled and you people have ensured that the
15 quality of that information is now at a level that it
16 can actually enter a regulatory proceeding and
17 survive. So, what's difficult for the general public
18 to understand is that there is an enormous amount of
19 information accumulating. It's getting woven together
20 into a better interactive set. Whether or maybe the
21 right question is how to move from the original site
22 characterization plan to something a little less
23 burdensome on the system is I think a management
24 question. My guess is DOE is struggling with that
25 themselves.

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1 DOCTOR NORTH: I think it will help them
2 a great deal though, is if you can join the struggle
3 with them to try to understand what information will
4 be enough given the change in the repository concept.
5 For example, if they go from vertical emplacement of
6 thin-walled containers to horizontal emplacement of
7 containers of the level of 125 tons, that will
8 obviously have very different implications for the
9 seismic analysis, for what information one might need
10 to have to be sure that ground motion and fault
11 displacement don't pose a serious challenge to the
12 integrity of the repository

13 Now, this is an area, one specific, where
14 we were somewhat dissatisfied in our meeting last week
15 that there had been a reevaluation of the test plans,
16 an additional analysis showing what kind of
17 information do you need at what time frame in order to
18 deal with those issues. So, we're concerned that DOE
19 not fall into the mind set of using the study plans as
20 a checklist. Yes, we have all these various data
21 elements that we agreed back in 1989 or whenever the
22 last revision was that we would provide. Rather, that
23 that whole process be reexamined so that we can assure
24 that as DOE proceeds it is getting the information
25 that is needed for the program, both the early

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1 determination of site suitability and the information
2 that they will need if they proceed to the licensing
3 application, and that the right sorts of priorities
4 are being set as they deal with budget limitations and
5 have to choose which elements of information they
6 will, in fact, provide you.

7 Another example would be how much drifting
8 in Yucca Mountain is really necessary. We understand,
9 based on Doctor Dreyfus' recent testimony, that they
10 are considering cutting back on some of the ancillary
11 drifting that we had originally anticipated would be
12 done to explore various fault structures. How
13 important is that information? I think it's very
14 useful for NRC and DOE to engage in dialogue on these
15 issues earlier rather than later so that they
16 understand the character of your thinking and you've
17 communicated to them your views of the criticality of
18 various information items.

19 CHAIRMAN SELIN: No offense meant, but I
20 don't understand your answer to the question. Are you
21 saying that we cannot work off a moving target?
22 That's the one thing that's absolutely clear. Are you
23 saying that the SCP should be --

24 DOCTOR NORTH: I think the target is
25 moving and the issue is how do we track it from both

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1 sides.

2 CHAIRMAN SELIN: We can't track it. We
3 have to have at some point a logical argument that
4 says, "We believe these are the questions that have to
5 be answered in order to satisfy you, the NRC's needs."
6 This is basically a design basis reconstitution
7 applied to a test plan.

8 DOCTOR NORTH: Yes. I think one wants to
9 avoid just in time engineering and analysis.

10 CHAIRMAN SELIN: But what I don't
11 understand is your recommendation on how that be done.
12 You don't want to redo the whole SCP since there's a
13 lot of other material in that.

14 DOCTOR NORTH: No. But, for example --

15 CHAIRMAN SELIN: You can't just sit down
16 and have an ad hoc discussion of issues. So, we have
17 to respond to a statement that says, "We now believe
18 these are the questions," and how should that
19 statement be put to us?

20 DOCTOR NORTH: Well, it seems to me that
21 one thing you might do is recognize that there is a
22 change in the baseline as they are conceiving it from
23 vertical thin-walled containers to the possible use of
24 an MPC in disposal phase as well as storage and
25 transportation phase, and a move to horizontal

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1 emplacement as opposed to vertical emplacement with
2 very different implications with respect to an air gap
3 versus backfilling around the container.

4 If you were not satisfied that their old
5 study plans are responsive in this new situation,
6 which I suspect you would not be, then it seems to me
7 you want to urge them to engage you in dialogue saying
8 how they are going to deal with a very different
9 situation than the test plans and the SCP that are a
10 matter of historic record now. I'm not sure that you
11 have to take all the initiative. You might ask them
12 to take the initiative.

13 CHAIRMAN SELIN: We can't do that. They
14 have to come to us and say, "Our plans have changed."
15 I mean obviously we know their plans have changed and
16 it's obvious that if they change the plans there's no
17 assurance that the old test will satisfy the new
18 questions. But until they come to us and say, "Our
19 plans have changed and here's our new test plan or at
20 least mod 1 of the test plan and here's how we propose
21 to answer this," we can't do that.

22 Your conversation sort of sees a student
23 and a teacher involved in a thesis discussion and
24 we're not. We're the panel at the end. What do you
25 call it, the defense board that has to take the thesis

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1 as given and say it passes or it doesn't pass.

2 COMMISSIONER ROGERS: We are very involved
3 with details now that we're very uncomfortable to what
4 extent we're getting sucked into, in a sense, telling
5 them what to do. We cannot do that for all kinds of
6 reasons. The concern is that we see these changes
7 taking place, but I guess they haven't really come to
8 us and said, "This is now what we propose to do and
9 we'd like to know to what extent we have to -- what do
10 we have to do to satisfy your concerns about that?"
11 I don't believe that's happened yet.

12 DOCTOR CANTLON: As I listen to the
13 rethinking -- and of course you've got new leadership
14 in there and they're just really getting in the saddle
15 now. So, I think it's premature to try to
16 characterize the way they're proceeding, but it does
17 seem to me that more in line with what the chairman is
18 contemplating, that I visualize DOE moving
19 aggressively to sort of lay out a real strategy,
20 thought through and so on, present that and then begin
21 to lay that out. Move in, get the mountain
22 characterized in their view as something adequate.
23 Then proceed with the licensure.

24 CHAIRMAN SELIN: If they come to us with
25 a Gadankin experiment, you know a virtual test plan,

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1 say, "If we had such a plan, we had such a
2 construction plan and we had such a verification
3 philosophy, would that meet our needs?" we can answer
4 those questions. But we can't be continuously
5 interacting with them.

6 DOCTOR CANTLON: And I think really one of
7 the elements of the cost of the program has been
8 probably a far too early wedding of the regulatory and
9 the conceptual aspect of the program. Early on, the
10 way they proceeded was really grounded in the detailed
11 regulations as opposed to really getting after the
12 Gestalt of what it was they were trying to do.

13 CHAIRMAN SELIN: What information do you
14 need to answer the safety questions.

15 DOCTOR CANTLON: Yes. And I think I see
16 for the first time DOE moving on what I think is a
17 much healthier way, and that is to put the regulatory
18 set of issues off until they're ready to come to y
19 with a pretty well articulated Gestalt of what the
20 system is going to look like, what it is they plan to
21 do now to document that that's going to be safe. I
22 think that's a much more intelligent and much more
23 cost effective way to get at this program. I'm very,
24 very encouraged by it.

25 COMMISSIONER ROGERS: One of the comments

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1 that -- well, a comment that you've made several times
2 in your report here is a reference to either a
3 comprehensive strategy when you're talking about
4 strategy, but the word comprehensive I think is the
5 important one, a systems analysis of a system or the
6 whole thing, and that seems to have been lacking
7 throughout the whole program. I think you've called
8 for that before years ago.

9 DOCTOR NORTH: Our first report.

10 COMMISSIONER ROGERS: Right. And yet that
11 seems to be the most difficult thing to get anybody to
12 do. We've tried here, just within some of our own
13 people in asking for a crack at a systems analysis
14 that absolutely feel absolutely flat. Couldn't do it.
15 You made the comment that it didn't have to be
16 complicated or it didn't have to be a big effort. But
17 it seems to be the stumbling block for all of these
18 big programs. I wonder if you have any thoughts as to
19 why that is, because that seems to me to be the thing
20 that's always lacking. It's always the Achilles heel
21 of a program, that everybody has got their focus on
22 the bits and pieces and lo and behold the thing falls
23 apart because they don't all fit together. It's
24 happened time and time again in major projects over
25 the years, and yet that seems to be the place where

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1 it's most difficult to get one's intellectual arms
2 around it.

3 Over the years I've wondered why this is
4 so difficult. I've had some ideas. Possibly it's the
5 tunnel vision of the professionals who can only look
6 at what they know very well and they just don't look
7 on either side far enough or are not interested in it.
8 It may be that their educations have been faulty in
9 that regard and yet it seems to be the most critically
10 absent element in any big project. Everything is all
11 cut up into pieces and everybody has got a piece of it
12 and then it doesn't all come together. I wonder
13 whether you see any hope here of actually getting hold
14 of this from that point of view. The appointment of
15 a chief scientist perhaps might lead to that approach,
16 but the very word "scientist" gives me a little bit of
17 discomfort there because scientists tend to look more
18 sharply focused at what they're interested in and
19 ignore those things that they feel are not critically
20 important to what their particular interests are, and
21 I happen to come from a science background.

22 So, I would have been perhaps even more
23 pleased to see now a chief scientist, but a chief
24 systems engineer appointed. Do you think there's any
25 possibility that -- I guess that person hasn't been

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1 named yet or I don't know what's been written down in
2 the way of qualifications that are being looked at,
3 but it seems to me it's not a scientific problem, it
4 really is a systems engineering problem that they have
5 on their hands. I wonder if you've expressed any
6 thoughts to DOE in that regard.

7 DOCTOR CANTLON: Yes. Well, as Warner
8 mentioned, from our view first report we've observed
9 the same criticism of the project. It was the absence
10 of a sort of overall Gestalt of the thing, a systems
11 view, conceptual design and so on that has been the
12 weak part of it. We raised that with each of the
13 OCRWM directors through the years. We have talked at
14 great length to the M&O that was hired essentially to
15 provide that synthesis.

16 To answer your question why it is that
17 it's so difficult, I think part of it as you've
18 indicated. You have individuals who are trained in
19 discipline, in multi-disciplinary studies in any human
20 activity are the most complicated and time consuming.
21 They're much more costly to do. I've been involved in
22 a number of them through my career and I must say none
23 of them are easy and they're very costly to get the
24 integration. It is a learning curve of getting the
25 disciplines to talk to one another in language they

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1 can actually use. When you now render it into models
2 in which the models have to articulate with one
3 another and then someone has to come in and simplify
4 them to get enough capacity in a machine to handle the
5 complexity of that operation, you've got another
6 level.

7 So, I guess I would say I'm beginning to
8 develop a degree of greater optimism than I've had
9 that they, A, understand what the challenge really is,
10 are beginning to put together the kind of people that
11 can address it. Have they done it yet? No. The M&O
12 people would tell you they're beginning now to really
13 lay down an attack on the problem.

14 And then coming back to the earlier
15 concept, and that is DOE as a totally unregulated
16 agency entered the regulatory world naive as hell and,
17 in a sense, let the regulation dictate what it was
18 they were to do. I think that contributes to the
19 difficulty they have had in bringing together this
20 Gestalt and conceptual design. But I think the people
21 who are in the chairs today, far better than any of
22 their predecessors, understand what the challenge is
23 and are, in fact, addressing it. So, I am beginning
24 to get optimistic. I'm not yet optimistic, but I'm
25 beginning to feel that I can see a degree of progress.

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1 DOCTOR NORTH: I'd like to expand on
2 Doctor Cantlon's answer with a few examples. In the
3 area of performance assessment, we encourage them in
4 our first report that this should be an iterative
5 exercise. One can't expect to get these complex
6 systems issues right the first time. You have to
7 practice and determine by iterative attacks on the
8 problem which are the most important issues and how to
9 refine in the right details. We perceive that that is
10 going along reasonably well now. They're beginning to
11 make a good deal of progress in terms of how to
12 integrate across the many geological issues and the
13 engineered barrier issues as well.

14 The move to consider the multi-purpose
15 container we view as an important step forward into
16 the system's work. A year and a half ago we were
17 criticizing them because we didn't feel they'd done a
18 good job of the system's tradeoffs. They have
19 presented us with analysis that is at least a good
20 start on those issues and we now feel that what they
21 need to do is to continue to do that analysis rather
22 than to stop with what is in the request for proposal
23 that they're about to put out. There may be
24 substantial risk that the first MPCs will not be
25 properly adapted for the disposal function, but that

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1 then will need to be recognized early so that we can
2 adapt the strategy accordingly.

3 So, we feel they're beginning to get the
4 idea. They're beginning to make some progress and
5 we're hopeful that they will continue and indeed
6 accelerate in terms of having systems engineering and
7 I'll call it top-down analysis as a way of focusing
8 the decisions in the program so that they use the
9 right scientific and technical information and not do
10 it piece by piece, discipline by discipline.

11 COMMISSIONER ROGERS: I was concerned
12 about your comments with respect to the cutbacks in
13 testing programs. Do you see that as turning around?
14 Are they beginning to turn that around?

15 DOCTOR NORTH: Yes. Listening to Doctor
16 Dreyfus' testimony today, it's clear that even if they
17 don't get expanded funding, it is their intent to
18 address more of their resources to the funding of the
19 needed science and engineering that is absolutely
20 essential to proceed. So, this is a good sign.

21 COMMISSIONER REMICK: There's one thing I
22 don't understand about the relationship between the
23 thermal loading and the multipurpose cask. I
24 understand that the question of thermal loading of the
25 repository is extremely important from a lot of

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1 geological, hydrology, all those type of things, but
2 it seems to me that the cask, whether it's a large
3 cask or a small cask on a macro scale, one matches the
4 cask with -- or the canister and its overpack with the
5 thermal loading by spacing. To me that doesn't seem
6 like it's a problem. Is it the other problem that the
7 thermal loading can affect what the canister should
8 consist of? There's something I don't quite
9 understand there.

10 DOCTOR CANTLON: The hydrologists in
11 creating the model of what happens in the unsaturated
12 zone, the heat from a high heat source will
13 essentially reflux the water out of the unsaturated
14 rock. That then will go up and condense and create
15 essentially cascades of water coming down into the
16 repository, and, if you now have a hot repository and
17 have them spaced evenly, you'll heat the whole
18 mountain up and that water will go up and leave the
19 repository. That's the model. The modelers are
20 saying that.

21 Now if you have very, very large
22 containers that will generate high heat, if you pull
23 them apart, then you get these little recyclings, and
24 that's -- but, again, it's at a modeling level and the
25 data look pretty convincing.

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1 COMMISSIONER REMICK: -- by the decay of
2 the fuel and so forth? I mean, there are --

3 DOCTOR NORTH: That's one dimension that
4 can help.

5 DOCTOR CANTLON: That would be one, but --

6 COMMISSIONER ROGERS: Yes, but then
7 there's the lifetime of the repository question there.

8 DOCTOR CANTLON: Indeed.

9 COMMISSIONER ROGERS: I mean, you know
10 it's going to be hot for a certain couple hundred
11 years, but then after that the spacing and so on and
12 so forth really starts to take over and become very
13 important, doesn't it?

14 DOCTOR CANTLON: Well, to get the hot
15 repository you want to age the fuel to get rid of the
16 high early peak and then pull the canisters in so you
17 get uniform heating and drive the temperature above
18 the boiling point of water and hold it there for
19 nearly 10,000 years, if you design it properly.

20 COMMISSIONER REMICK: Are we talking about
21 that much variation in a multipurpose canister?

22 DOCTOR CANTLON: Oh, yes.

23 COMMISSIONER REMICK: Because, I think
24 there are limitations on transportation with the
25 overpack for transportation on what you can carry. It

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1 doesn't seem to me that there would be that great a
2 variation in canister size.

3 DOCTOR CANTLON: They're talking about 21
4 fuel assemblies, which is a pretty good size
5 container.

6 DOCTOR NORTH: 125 tons.

7 COMMISSIONER REMICK: But the other
8 direction would be one fuel element, right?

9 DOCTOR NORTH: Yes.

10 COMMISSIONER REMICK: Between one and 21.

11 DOCTOR NORTH: Hauling them one unit at a
12 time through the transportation link makes for very
13 expensive transportation.

14 COMMISSIONER REMICK: I agree. So it's
15 not one and 21. It's probably something in-between.
16 How much variation in heat generation are we talking
17 about here that would affect the local recyclings?

18 DOCTOR NORTH: Well, let me explain some
19 of the issues involved.

20 COMMISSIONER REMICK: Yes, please.

21 DOCTOR NORTH: One of the things that
22 we're concerned about is the alteration of the
23 geochemistry. For example, as you boil that water out
24 of the rock you leave certain salts behind in the
25 fractures such that, if the water starts to drip down

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1 that fracture at a later time when the repository is
2 cool, it picks up some very corrosive materials that
3 might then drip on the container. So, we're concerned
4 that those issues should be understood and dealt with
5 appropriately.

6 DOE's recent performance assessment
7 looking at the container included scenarios all the
8 way from the container lasts only a hundred years
9 because of such corrosion processes at one extreme all
10 the way to the container will last for a million years
11 at the other extreme.

12 COMMISSIONER REMICK: So should I conclude
13 one shouldn't decide about the MPC until all those are
14 solved?

15 DOCTOR NORTH: What we are concerned about
16 is that both the materials science research, the
17 container materials, and the behavior in the altered
18 zone, as they're calling it, that being a new term for
19 what we used to call "near field," be well understood
20 so that those scenarios have been appropriately
21 evaluated and we have designed the full set of
22 engineered barriers as well as possible.

23 COMMISSIONER REMICK: That tells me don't
24 go ahead with the MPC at this time.

25 DOCTOR NORTH: Well, what it says is we

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1 might want a flexible MPC strategy that can be
2 suitably adapted. For example, we can put the right
3 overpack on an inner wall that is compatible with a
4 variety of overpacks and which has the flexibility to
5 accommodate different designs with appropriate
6 corrosion resistance.

7 DOCTOR CANTLON: See, there are
8 possibilities that the initial MPCs which are driven,
9 of course, because the utilities want to get out from
10 under the burden, you know, those could be put into an
11 underground MRS for a while and just well-ventilated
12 for a hundred years.

13 COMMISSIONER REMICK: Why underground?
14 Even simpler above ground, isn't it?

15 DOCTOR CANTLON: Well, it might be. Might
16 be.

17 COMMISSIONER REMICK: I think it would be,
18 wouldn't it?

19 DOCTOR CANTLON: Well, it all depends on
20 where it is. If you're going to haul them out to the
21 site -- the whole MRS issue, you know, is really up in
22 the air now and it doesn't look like it's going to
23 come any earlier than the repository at the rate
24 they're going.

25 COMMISSIONER REMICK: Another question.

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1 Explain to me percolation flux. I understand -- I
2 know very little hydrology and geology, but I can
3 picture measuring ground water travel times. I can
4 out to 1,000 years either with post-activation neutron
5 analysis or techniques that people use on a shorter
6 period of time, so I think you can measure water
7 travel time somewhat reasonably. But how do you
8 measure percolation flux and relate that to some
9 reasonable measure of how the water would travel over
10 large distances?

11 DOCTOR NORTH: I think I can describe the
12 problem. I'm not sure I can describe the solution.
13 I think the character of the problem is that one
14 number may not be enough. You may have a relatively
15 wide fracture in one spot that acts as a shunt that
16 takes the water down to repository depth relatively
17 quickly where nearby the flow is through the matrix of
18 the rock rather than the fracture and it may take
19 100,000 years.

20 COMMISSIONER REMICK: Isn't that true
21 whether I measure percolation, flux, or ground water
22 travel time?

23 DOCTOR NORTH: Well, you're in an
24 unsaturated zone, so it's a very inhomogeneous kind of
25 a medium.

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1 COMMISSIONER REMICK: That I understand,
2 but how does percolation flux solve that problem? It
3 seems to me that's a problem, I agree, but how does --
4 there's something I'm missing.

5 DOCTOR NORTH: I think what we're looking
6 for is a set of modeling tools that will allow us to
7 deal with the unsaturated zone geohydrology such as we
8 find it.

9 COMMISSIONER ROGERS: Well, isn't the
10 issue that if you're talking about ground water travel
11 time you're talking about travel time, period?

12 DOCTOR NORTH: Yes.

13 COMMISSIONER ROGERS: And anything you can
14 possibly measure, however small. If you're talking
15 about flux, you're talking about quantity, and so
16 that's a different kind of measure.

17 DOCTOR CANTLON: The point variability is
18 enormous.

19 COMMISSIONER REMICK: Quantity per unit
20 time, right?

21 COMMISSIONER ROGERS: Yes, but, I mean,
22 it's quantity. But the point is that it's a measure
23 of how much gets out, not does any get out, and how
24 soon is the earliest precursor of a larger flux, you
25 know, get out. I mean, when you have travel time the

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1 first you can detect, I take it, is the travel time
2 when you first detect something. And you're not
3 measuring flux. You're not measuring quantity.
4 You're not saying there's a lot of this stuff coming
5 out. It may be a few molecules, but you've detected
6 it, and so travel time is just a point measurement
7 whereas flux gives you essentially more of a sense of
8 what the quantity is that's coming out.

9 COMMISSIONER REMICK: Yes, but I would
10 think flux would be a very local measurement. It
11 seems to me the flux would --

12 COMMISSIONER ROGERS: Well, they're all
13 going to be local measurements, aren't they, I mean,
14 in a sense? But if you're talking about just point by
15 point measurements of travel time and you've got a
16 bunch of numbers there, that still may not be any
17 quantity of anything coming out. You've just -- you
18 may be able to detect the first arrival, but you
19 haven't said how much is coming along with that.

20 DOCTOR CANTLON: Depending on where it's
21 going and where it's been. It's an extremely
22 complicated problem of trying to bet at it, unlike in
23 the saturated zone where you're really looking at
24 ground water travel time from a repository where you
25 have toxic or hazardous materials in one point.

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1 You're not trying to calculate where it's going. In
2 a saturated zone you've got a very, very different
3 thing, and that's I think where your language came
4 from. Everybody was thinking about a saturated zone
5 problem.

6 COMMISSIONER REMICK: No, I agree with
7 that. But what I don't understand is measuring
8 percolation flux, unless I can't visualize what one
9 does in that, how you're going to do that. What we're
10 worried about is release, I assume, from the site
11 where the public might be, how we're going to do that
12 over great differences and have any meaning to it,
13 because it seems to me it would vary.

14 DOCTOR CANTLON: It would vary all over
15 the map.

16 COMMISSIONER REMICK: And so I don't know
17 physically how we're going to do it in a meaningful
18 way.

19 DOCTOR NORTH: Well, we may have to look
20 at fracture flow and matrix flow as different
21 phenomena and have models that will deal with each of
22 them and deal with them in different regimes. Nevada
23 in geological history, recent geological history, has
24 been much wetter than it is at the present time. Now
25 what does this mean in terms of flow through the

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1 unsaturated zone?

2 COMMISSIONER REMICK: Good question. Good
3 question. Okay. I'll talk to our hydrologist and see
4 if I can't get a better understanding of how we're
5 going to do this.

6 I don't want to belabor the issue of our
7 involvement and the strategy. I think that's been
8 elucidated by Commissioners Selin and Rogers. We just
9 don't do that, and so I don't want to belabor it. We
10 respond.

11 But you brought up another point which I
12 think is related. You said something about, I think,
13 you recognize that Part 60.113 has flexibility, has
14 other words, "or as the Commission might otherwise
15 decide" or something like that. But you asked the
16 question, "At what point does the NRC identify those
17 goals," and I think the same answer applies there. It
18 seems like it's an infinite number of possibilities
19 that we might hypothesize, what might be needed and so
20 forth, so once again I would just stress that DOE
21 should bring us proposals that we can consider and
22 give an answer to, hopefully in a timely manner, and
23 that's the way we have to respond.

24 We can't anticipate all the possibilities
25 that DOE might face and the possible solutions. It

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1 would be a never ending process. It may be
2 unfortunate that we are one of those "bring us a rock
3 and we'll tell you if it's the right rock and, if not,
4 bring us another rock." We're sometimes criticized
5 for that, and rightfully so, but it also makes some
6 sense that people have to bring us proposals that we
7 can analyze and hopefully get an answer to.

8 DOCTOR NORTH: To me this is a very
9 important insight that I've learned from this meeting,
10 that perhaps we as a Board should be stronger in
11 recommending to DOE -- our job, after all, is to
12 criticize their program -- that they should take a
13 more proactive role in coming to you with, let me call
14 it "strategy," instead of the details at the level of
15 study plans.

16 CHAIRMAN SELIN: That's true as long as
17 there is at the end of their proposal on the table to
18 which we can respond on an open ended proposition.

19 DOCTOR NORTH: Yes.

20 CHAIRMAN SELIN: You know, we're normal
21 folks. We have a lot of people who find this really
22 interesting. They love to start going back and forth
23 with details, but that's not our job. We have to
24 guard against being coopted, being part of the piece,
25 et cetera. We're already in a very tricky, very

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1 sensitive situation.

2 COMMISSIONER REMICK: That's all I had.
3 Thank you.

4 CHAIRMAN SELIN: Let me go back to a point
5 that Commissioner Remick raised. I now think of a
6 better way to state my question to you. It would be
7 interesting, you might find it a useful way to pose
8 the question on the multi-purpose canister, about
9 whether there's likely to be any benefit to even
10 include the eventual repository use in the design at
11 this point, whether there's enough information to make
12 that useful or whether it's just likely to take enough
13 time and effort that should just be left for another
14 stage because it's very clear what one would do in
15 terms of a dual purpose canister. One can talk about
16 the possibilities of overpacks, but trying to analyze
17 a non-defined situation has an enormous possibility
18 for delay.

19 Now, it's not our business whether that's
20 done or not, but it is our business that the fuel,
21 even at the power plants, be taken good care of and if
22 we see people heading to an approach that's likely to
23 slow things down, I think it's reasonable for us to
24 say, "What are you doing? Is there a likely benefit
25 to making the design and the analysis much more

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1 complicated?" Were you to undertake that question,
2 that might not be a bad way to pose the issue.

3 DOCTOR CANTLON: If the risk proves to be
4 a warranted risk, one that pays off in the end, the
5 American taxpayer and the utilities and everybody else
6 will be substantially advantaged. So, it's probably
7 a warranted kind of risk, providing -- you know,
8 accepting the fact that DOE feels obligated that it
9 must move by 1998. If you look at European and other
10 countries where they really built in interim storage
11 in their system to begin with, none of them are under
12 this kind of a time line. So, we end up with a much
13 more complicated challenge on our hands and this, I
14 suppose, warrants some risk taking which DOE appears
15 ready to do.

16 CHAIRMAN SELIN: Well, I also heard Doctor
17 North's answer as saying one might not even know how
18 to pose the question about what features would be
19 called for in order to be able to comply with an
20 ultimate repository when the design is so early. I
21 hate to be this responsive to a question that has been
22 asked, but he's almost trying to kill three birds with
23 one stone, two of whom are in one thicket and one is
24 flying around we don't know where.

25 DOCTOR CANTLON: Well, the primary issue

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1 is canister size.

2 CHAIRMAN SELIN: Yes. You sort of
3 broached the question, so let me ask you directly.
4 What reaction, if any, would you have to the concept
5 of first doing an MRS and then eventually doing a
6 repository in Nevada if the law allowed that, since
7 that's been raised?

8 DOCTOR CANTLON: MRS in Nevada?

9 CHAIRMAN SELIN: Yes.

10 DOCTOR CANTLON: It makes imminent sense
11 to everybody except Nevada.

12 CHAIRMAN SELIN: Well, specifically
13 Senator Johnson has raised the issue and Doctor
14 Dreyfus was not prepared to answer that. But from a
15 technical, scientific, et cetera --

16 DOCTOR CANTLON: Well, you'll recall from
17 our testimony last year that we raised the question we
18 shouldn't be in a big hurry to close the repository,
19 that a great deal of reassurance will be given to
20 everyone if we can monitor those canisters out into
21 the future substantially longer than the 50 years
22 originally visualized. So, in a sense that makes it
23 an underground MRS.

24 So, the difference between a repository
25 and an underground MRS at a licensure level is, I

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1 think, one of the things that makes a difference. You
2 wouldn't necessarily have to provide confirming data
3 on the behavior of the site should half the canisters
4 leak or ten percent of them leak if you were going to
5 have the capacity to put it in and take it out.

6 CHAIRMAN SELIN: Let me see if I
7 understand it. You're, in effect -- I mean I'm
8 putting words in your mouth, so make sure these are
9 the right words. You're in effect defining an MRS as
10 a reopenable or --

11 DOCTOR CANTLON: Non-closed.

12 CHAIRMAN SELIN: -- non-closed repository,
13 not a repository that adds features. It might be
14 appropriate for an intermediate period, with such
15 features as institutional things or active ventilation
16 or things like that. You're talking about basically
17 the same design, just not sealed.

18 DOCTOR CANTLON: No. If you were really
19 going to operate it for a long time, you'd probably
20 want some additional ventilation. You'd want long-
21 lived ventilation instead of short-lived ventilation.
22 Our Board has not discussed this. So, I'm a little
23 hesitant to get into any details.

24 DOCTOR NORTH: We would be eager to see
25 DOE's analysis on these issues and we have not seen

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1 any of them. It is certainly the case that as the
2 fuel is aged and becomes cooler some of the problems
3 of repository design become more tractable. Now, one
4 could cool the fuel underground or one could have an
5 MRS on the surface on the surface at that site, which
6 would eliminate the need for further transportation.
7 We think that it would be useful for those concepts to
8 be explored. It's hard for me to judge how much it's
9 appropriate for DOE to do that under the existing
10 state of the law. But I certainly welcome the
11 discussion that apparently occurred at the recent
12 hearing between Senator Johnson and Doctor Dreyfus.

13 CHAIRMAN SELIN: I was just trying to
14 figure out what an intermediate storage at a
15 repository meant, whether it was just not closing the
16 site irrevocably or whether it was using features,
17 adding features that one might use for 100 years that
18 you couldn't use for 10,000 or 20,000.

19 DOCTOR CANTLON: There are a number of
20 things that one could visualize. For instance, you
21 might want a little bit better drain control in the
22 floor of the drifts pretty much like some of the low-
23 level waste containers in which you have total
24 containment should there be a breach. So, it could
25 have design features.

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1 CHAIRMAN SELIN: Let me go on -- if we can
2 talk strategy, we can then even go further and talk
3 philosophy. We've been admirers of your reports and
4 at the same time have sort of wrung our hands that
5 they seem to have had so little impact on the project.
6 Is there some understanding of why they've had so
7 little impact? More precisely, whether there's any
8 reason to believe that things will be different now
9 and they'll have a greater effect?

10 DOCTOR NORTH: I'm not sure I would agree
11 with your premise. It seems to me we've had a lot of
12 impact on their program. We can certainly identify
13 issues and areas where our advice has not been heeded.
14 But there are many, many others where our advice has
15 been heeded. The issues have been picked up and have
16 become central issues within their program and in many
17 instances they have taken a suggestion from ours and
18 that has become the character of the new program. For
19 example, the exploratory studies facility, which used
20 to be called exploratory shaft facility.

21 DOCTOR CANTLON: I would say that we can
22 identify a number of areas where they clearly have
23 listened to what we've said. So, the areas where they
24 have gone their own way, maybe the most dramatic one
25 was on tunnel size where we had a clear difference of

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1 opinion. This all depends on one's attitude about
2 whether the repository is going to be there or not.
3 We felt it would have been absolutely meeting the
4 requirements of assessment to use a smaller diameter
5 tunnel. On the other hand, if you're going to drill
6 a tunnel and it's going to be successful as a
7 repository, it might be big enough to handle that.

8 But the other areas, we criticize them on
9 systems. They have aggressively addressed the systems
10 in again a kind of an iterative fashion. So, I think
11 as one looks at the major questions we've raised,
12 we've seen the program change. Now, a good bureaucrat
13 makes changes on his own initiative and we do our best
14 job if they invent solutions that coincide with our
15 criticism. So, I guess I don't worry too much about
16 whether or not DOE jumps through each one of the
17 hoops. After all, we're a critic, an assessor, not a
18 manager. They have many, many tough management
19 issues. I've sat in management roles a good part of
20 my life and the manager is very, very different from
21 the auditor.

22 CHAIRMAN SELIN: I apologize for the
23 tactless way in which I put my question. Let me
24 rephrase it.

25 You clearly had a big impact on the design

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1 of the facility and a number of technical and tactical
2 questions. But the three grandest questions you have
3 come at again and again without their responding.
4 Number one is why does so little money go into the
5 hole in the ground? Number two is why don't you
6 distinguish between what it takes to characterize the
7 site versus to build a site, which is not exactly the
8 same question. And number three, why don't you do an
9 overall systems analysis instead of breaking it off
10 into pieces, which as several of you said took not the
11 laws that nature has given but Part 60 has given and
12 worked against that. Those have been, in one way or
13 another ever since your first report, ultimately,
14 really infinitely sensible things.

15 My attempt to be complimentary clearly
16 backfired a little bit, so we'll start again. But is
17 there any reason to believe you will get different
18 responses to those three questions now?

19 DOCTOR CANTLON: Yes. I must say I
20 listened to Doctor Dreyfus' testimony today and I
21 think he addressed each one of those three issues.
22 They are going to aggressively now look at site
23 characterization and put the licensure set of issues
24 secondarily. That we've argued from the beginning.
25 Their systems work, as I was commenting in more detail

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1 earlier, we think is now on a trajectory of coming to
2 closure in an interactive fashion. He explicitly told
3 the Appropriations Committee today in the hearing that
4 they were shifting more of the funding into the direct
5 science and technology issues and diminishing the kind
6 of interaction they have with the regulatory side of
7 the issues. So, I guess I would say they've now
8 invented the solution and that's great.

9 DOCTOR NORTH: We have brought up the
10 recommendation for a management review of the overall
11 program, not just the project, in part because we
12 don't feel we're terribly well qualified to deal with
13 the first two issues on your list which really
14 transcend the kinds of scientific and technical issues
15 that our Board is well qualified to deal with. We're
16 encouraged by the recognition that these are indeed
17 problems by Doctor Dreyfus and his new management and
18 it would be wonderful if those problems get solved
19 reasonably quickly. We're not optimistic that they
20 can be solved in months or even a few years. It's
21 going to take some dramatic restructuring of the
22 program, we think, to do that. But it's really not
23 our expertise how that restructuring should be carried
24 out. That's really a management task.

25 COMMISSIONER ROGERS: I wonder if you

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1 could just say a little bit more about your
2 recommendation that NRC proceed to amend Part 60
3 before the National Academy report is in? It sounds
4 a little bit contrary to the general approach that
5 you're suggesting and everything else in your report,
6 namely that we plow ahead with a process that takes a
7 couple of years to do without having in hand the NAS
8 report which ought to be available within that time.
9 I feel a bit uncomfortable with that recommendation.

10 DOCTOR CANTLON: Well, I guess what we're
11 saying --

12 COMMISSIONER ROGERS: I mean I don't know
13 exactly what you're referring to in the changes.

14 DOCTOR CANTLON: What we're saying is that
15 if you put each one of these in sequence, you've now
16 pushed the regulatory situation quite a ways into the
17 future. You're at least two years away probably. We
18 were just wondering whether you couldn't have now that
19 you could be responding to the 1992 Act which is
20 addressing site characterization for Yucca Mountain,
21 if you couldn't be a lot more explicit in site
22 assessment as opposed to choosing sites, that there
23 are ways that things might be addressed differently.
24 The language, for instance, of the total system being
25 the licensable unit, the engineered and the non-

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1 engineered, we thought some thinking internally might
2 actually speed that process, while if you have nothing
3 done beforehand you wait until NRC is done and EPA is
4 done and now you've gotten it. You're three agencies
5 later and we thought maybe you could save some time by
6 giving that --

7 COMMISSIONER ROGERS: Well, some kind of
8 a parallel effort that doesn't necessarily lead to a
9 final rule before --

10 DOCTOR CANTLON: Oh, absolutely.

11 COMMISSIONER ROGERS: Is that really what
12 you're talking about?

13 DOCTOR CANTLON: Oh, absolutely. Just
14 thinking through the different challenge that you're
15 now posed with as opposed to when the original regs
16 were written.

17 DOCTOR NORTH: The language that is in
18 Doctor Cantlon's statement is that the Board
19 encourages NRC to develop needed guidance or
20 amendments now rather than waiting until completion of
21 the reviews that are in process at this point. We're
22 urging you to anticipate, not make a final ruling of
23 any kind. Clearly you don't want to do that.

24 COMMISSIONER ROGERS: Yes, but that
25 guidance has a very heavy effect.

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1 DOCTOR CANTLON: Yes, you have to be very
2 careful, obviously. The public is looking over your
3 shoulder.

4 COMMISSIONER ROGERS: I mean, that
5 guidance is something that people in general take
6 very, very seriously, so it's not a just kind of
7 general admonition to do good. There's meat in the
8 guidance, usually.

9 DOCTOR NORTH: Well, in some cases you may
10 want to encourage dialogue among a number of
11 organizations and affected parties on the issues to
12 try to clarify the situation before you commit
13 yourself in any formal way.

14 COMMISSIONER ROGERS: Well, that sounds
15 very reasonable. Thank you.

16 COMMISSIONER REMICK: Any guess on when
17 the Academy study will be out so we have that in
18 sight?

19 DOCTOR CANTLON: Not from me.

20 COMMISSIONER REMICK: You clarify one
21 issue, a question I had about the size of the boring
22 machine, but you made a statement in your testimony
23 that was something like that the approach being used
24 by DOE is not consistent with modern mining technology
25 or underground construction. Was that only the size

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1 or was there more to that?

2 DOCTOR CANTLON: No, no. That didn't
3 refer to the size, although that also would be true
4 that they would go to the smallest size tunnel that
5 would do because they're stronger and a whole lot of
6 other reasons, but it really has to do with the way
7 you operate and contract with it when you have that
8 kind of a valuable machine sitting there. When it's
9 sitting it's using money, and so there are approaches
10 to managing those things. For instance, you could run
11 three shifts instead of one shift. You'd set it up so
12 that you'd have a very rigorously defined way in which
13 the scientists would come in and get at it and you'd
14 design ways in which they can get at it without having
15 the machine shut down, as long as it can be made safe.

16 But it really dealt with the experts that
17 we had who manage underground things like metros and
18 all those good things, irrigation systems, and they
19 were just surprised at the nature of the contracting
20 and the lack of sufficient rewards and so on for
21 efficient use.

22 DOCTOR NORTH: For example, many
23 underground construction operations are set up so that
24 the construction firm owns the machine. If something
25 goes wrong with the machine, they are under great

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1 incentive to get it fixed and get it operating. In
2 this situation, DOE is going to own the machine and so
3 the contractor is much less motivated to diagnose
4 problems and get them fixed as quickly as that is
5 possible.

6 COMMISSIONER REMICK: The three shift
7 versus one shift, is that a budgetary type thing?

8 DOCTOR CANTLON: Oh, sure.

9 COMMISSIONER REMICK: A limitation?

10 DOCTOR CANTLON: That old water meter
11 really runs when you've got three shifts going.

12 DOCTOR NORTH: And we have that problem
13 right now with the LM300 drilling rig, very expensive
14 state-of-the-art machine which they at this point only
15 have money to run on one eight hour shift a day. Now
16 we are urging that that problem not be replicated with
17 respect to the tunnel boring machine.

18 COMMISSIONER REMICK: If DOE was
19 successful in getting additional budgetary that
20 they've asked for, would that help solve that problem?

21 DOCTOR CANTLON: Yes.

22 COMMISSIONER REMICK: So it's purely
23 budgetary? That's why DOE --

24 DOCTOR CANTLON: No, no, there's -- and
25 they are addressing the question of contracting styles

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1 and so on, so, no, it's more than simply money. It's
2 how they spend that money.

3 COMMISSIONER ROGERS: There is a
4 cautionary note there, though, I think, that has to be
5 exercised. My recollection is, on a visit that I had
6 to the Canadian laboratory, underground laboratory, I
7 believe that's where I heard this a couple years ago,
8 that they pointed out, I think, that as they did
9 drilling there that they could not allow the
10 contractors to follow the customary mining practices
11 where, you know, you've got to get through a certain
12 number of feet per day and so on and so forth however
13 you can because they felt that the condition of the
14 walls that was very important for their purposes could
15 not be maintained under the normal style of
16 underground mining and that they had to therefore
17 impose additional requirements that would not be
18 acceptable if you were simply going to go and drill
19 for -- you know, if you were creating a mine for ore
20 or something of this sort.

21 DOCTOR CANTLON: I think this was a drill
22 and blast technology.

23 COMMISSIONER ROGERS: Well, yes, but it
24 was even more than that, I think, so that the
25 condition of the walls was very important in their

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1 view and that they had to pay more to get the kind of
2 condition that they wanted, so I'm not sure that just
3 simply taking over customary mining practices would in
4 fact be acceptable without some modification there.

5 DOCTOR CANTLON: Yes. We would agree.

6 CHAIRMAN SELIN: I gather you'd feel
7 better if they started with that and had specific
8 reasons for falling off it instead of just --

9 DOCTOR NORTH: Yes, and we asked for those
10 types of reasons early in the program. That was one
11 of the reasons why they decided they would not pursue
12 shafts with drill and blast excavation, that the
13 tunnel boring machine offered many advantages in terms
14 of the character of the walls.

15 CHAIRMAN SELIN: Okay. Well, you failed
16 only in one aspect. You have not proved to us that
17 you're incompetent to ask management questions to go
18 with the technical questions, but otherwise we thank
19 you very much for an excellent session and apologize
20 a little bit for asking questions that we really
21 should put to DOE as well.

22 Thank you for coming in.

23 DOCTOR CANTLON: Thank you.

24 (Whereupon, at 3:25 p.m., the above-
25 entitled matter was adjourned.)

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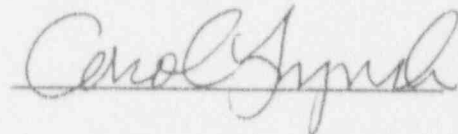
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DATE OF MEETING: MARCH 14, 1994

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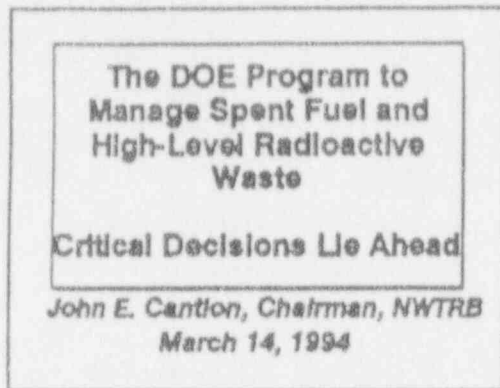
**The Department of Energy's Program to Manage
Civilian Spent Fuel and Defense High-Level Radioactive Waste:
Critical Decisions Lie Ahead**

**Dr. John E. Cantlon
Chairman, Nuclear Waste Technical Review Board**

U. S Nuclear Regulatory Commission

*March 14, 1994
Rockville, Maryland*

Viewgraph 1

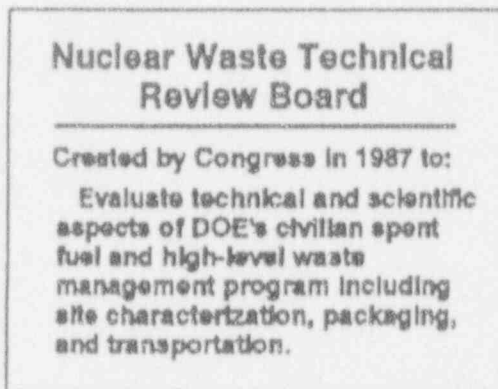


Good afternoon, ladies and gentlemen.

It is a pleasure to be here today. My name is John Cantlon, and I am Chairman of the U. S. Nuclear Waste Technical Review Board. Accompanying me is Board member Warner North. Approximately one year ago, we talked to you about the Board and its perspectives on the Department of Energy's (DOE's) program

to manage civilian spent fuel and defense high-level waste. Today, we would like to update you on progress during the past year and on the Board's views regarding some of the key decisions we expect the DOE to be facing during the coming year. Then, we will provide some observations on the NRC's role in this effort, and will close our remarks with a brief synopsis of the Board's latest report to Congress and the Secretary of Energy.

Viewgraph 2



The Nuclear Waste Technical Review Board was created by Congress in the 1987 Nuclear Waste Policy Amendments Act and is charged with evaluating the technical and scientific aspects of the DOE's waste management program. This includes site-characterization activities and activities relating to the packaging and transport of high-level radioactive waste and spent nuclear fuel. As you are aware, the Board is an independent agency within the federal

government, not part of the Department of Energy or any regulatory agency.

Viewgraph 3

Board Members	
Chairman Cantlon	Donald Langmuir
Clarence R. Allen	John J. McKetta, Jr.
Garry D. Brewer	D. Warner North
Edward J. Cording	Dennis L. Price
Patrick A. Domenico	Ellie D. Verink, Jr.

Members of our Board are nominated by the National Academy of Sciences and are appointed by the President. I have served from the Board's creation and became its second chairman two years ago. Currently, ten of the Board's eleven memberships are filled. I have listed the members for you on this viewgraph. We all serve part time.

The Board is organized into seven panels. They are shown on the next viewgraph.

Viewgraph 4

NWTRB Panels
<ul style="list-style-type: none">• Structural geology and geoen지니어링• Hydrogeology and geochemistry• Risk and performance analysis• Transportation and systems• The engineered barrier system• The environment and public health• Quality assurance

Since the Board's inception, and especially during the past year, the Board has witnessed considerable progress in the civilian high-level waste management program. For example, after several delays, construction of the underground excavation of the exploratory studies facility at Yucca Mountain has been started. Also, the management and operating contractor is beginning to integrate the DOE's efforts in all the components of the waste

management system — storage, transportation, and disposal. The Board strongly believes the momentum of these activities should be maintained.

The coming year promises to be one of additional progress, and also one during which many important decisions will be made. Some of these decisions are the direct responsibility of the DOE. An example is the decision whether to pursue development of a multipurpose canister design. Other decisions will involve interactions with other bodies, especially the Nuclear Regulatory Commission. Here, an example would be a decision whether to amend the siting guidelines of 10 CFR Part 960. Still other decisions, for example regarding the administration's proposal to Congress for disbursing Nuclear Waste Fund receipts, will not be made by the DOE, but the civilian high-level waste management program will be strongly affected by them.

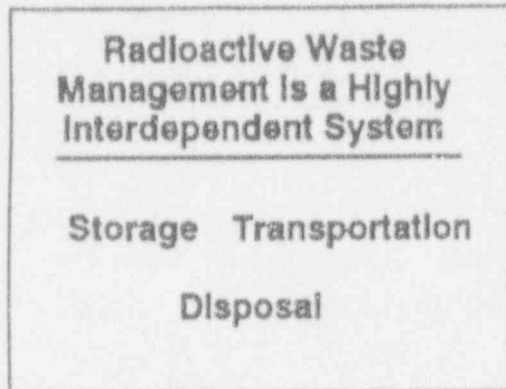
The Board has been encouraged by Secretary O'Leary's recent efforts to improve the program. For example, she has created the position of chief

scientist; she is proceeding with a financial and management review of the Yucca Mountain project; and she has taken steps toward broadening stakeholder participation in the program. On October 7, 1993, Dr. Daniel Dreyfus was confirmed as director of the Office of Civilian Radioactive Waste Management (OCRWM).

At our Board's January 1994 meeting, Dr. Dreyfus listed several short-term goals the OCRWM program had set for itself. These include "returning the emphasis" of the repository program to science and site characterization, "institutionalizing stakeholder interaction," and proposing a new funding mechanism to increase monies going to the OCRWM program. To achieve this latter goal, the DOE recently requested the creation of a special fund to give the OCRWM increased access to revenues coming into the Nuclear Waste Fund.

In the Board's view, relatively too little funding has been going to the direct costs of the scientific research and engineering activities essential to characterizing the Yucca Mountain site and to laying a sound basis for the waste management system. Based on its four-year review of the program, the Board believes that simply increasing the program's funding will not ensure that adequate funds will be allocated to the most important site-characterization activities or to other critical research. In a February 1994 letter to Congress and to Secretary O'Leary, the Board repeated its earlier recommendation for an independent review of the OCRWM's management and organizational structure to be initiated as soon as possible. The Board believes that this review can and should be undertaken without slowing the momentum of important site-characterization activities currently under way at Yucca Mountain. Whether the program budget remains level or is increased, program management should ensure sufficient and reliable funding for site characterization, performance assessment, and systems studies, which are critical for integrating the program.

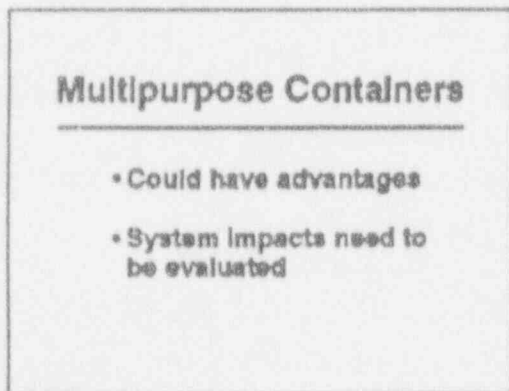
Viewgraph 5



The Board believes that the management of spent fuel and high-level waste, that is, the transport, storage, and disposal of waste, should be viewed as a system whose separate elements and subelements are highly interdependent. The Board has been concerned that DOE decisions about some components of the overall waste management system are being made without adequate regard for the effects those decisions could have on other

system components or on the entire system. In our presentation to you last year, we discussed the Board's views on several of the major issues facing the program at that time. Today, I would like to update you on the Board's views on two of those subjects: development of a multipurpose canister and research on engineered barriers. Then, I would like to summarize the conclusions and recommendations of a recent Board report on underground exploration and testing at Yucca Mountain. Finally, I will close my remarks with some observations about the NRC's regulations for a high-level waste repository.

Viewgraph 6



First, the DOE is now examining the feasibility of a concept it calls the multipurpose canister (MPC). This concept involves permanently sealing spent fuel in a canister at the reactor where the spent fuel is generated. During all subsequent storage, transportation, and disposal operations, spent fuel would remain sealed within the MPC. If necessary, overpacks or casks could be used for shielding and protection during storage or transportation,

or to provide corrosion resistance after disposal. But this is not simply a storage-related decision.

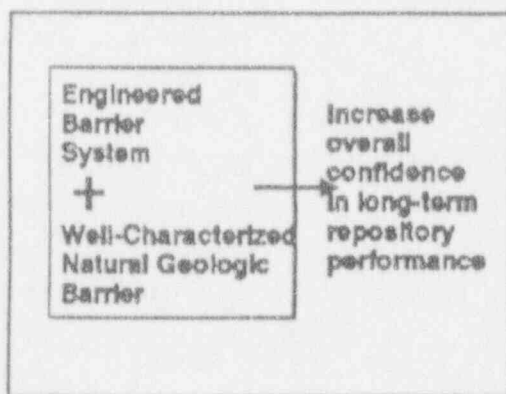
Development of an MPC has potential ramifications for a decision about the thermal loading of a repository, and the thermal loading decision, in turn, will affect how much waste can be put into one repository; how the waste will be loaded into canisters; how long waste must be aged prior to disposal; how the waste is packaged, handled, transported, and emplaced in the repository; and how and when the drifts are back-filled. It also will

affect how much the overall waste management program will cost. Therefore, MPC development decisions, as well as the decision about the thermal loading, should be approached carefully, especially since future underground thermal tests will be required to support a thermal-loading decision.

The DOE has evaluated alternative MPC designs and has studied the effects of those designs on the rest of the waste management system. In general, large MPC designs offer economic advantages, but often affect other parts of the waste management system, such as the repository design. The Board believes that a systems analysis is an important prerequisite to the final design of an MPC. Such an analysis, which does not require a large-scale effort, should assess the trade-offs of alternative concepts for the major parts of the system — storage, transportation, and disposal — and provide a technical basis for decision making. Given the uncertainties associated with disposal (e.g., the thermal load of the repository), the question of how a true multipurpose canister can be made a reality is a difficult one. Nonetheless, an attempt at least should be made to address this issue in a substantive way, given present technology and what is known about the repository and the site.

A second issue that concerns the Board is the low priority the DOE has placed on studies of engineered barriers.

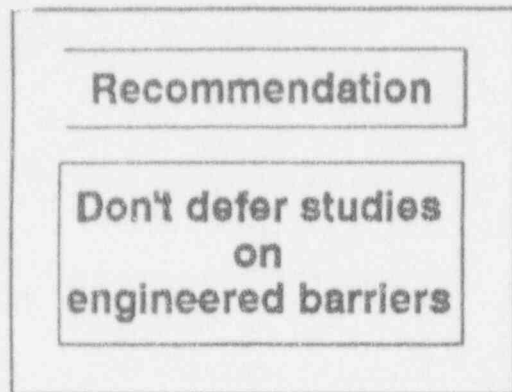
Viewgraph 7



A well-designed system of engineered barriers working together with well-characterized geologic barriers will increase our confidence in the long-term performance of a repository. For this reason, the Board has recommended that the DOE place greater emphasis on the engineered barrier system as a way to build redundant radionuclide containment into the repository design. This redundancy, in our view, should help add confidence about

repository safety, especially in the face of the inevitable uncertainties associated with predicting natural geologic, hydrologic, and climatologic processes far into the future.

Viewgraph 8



With respect to designing the waste package itself, the Board believes that extensive materials testing is required. Of greatest importance is determining how various materials will hold up over long periods of time under possible underground conditions. Despite this strong and repeated Board position, the DOE has, until recently, chosen to reduce the funds going to the waste package development program. We believe it is unwise to defer

studies in this area. As the DOE reviews its budget priorities during the coming year, the Board recommends that increased funding be directed to engineered barrier development.

In October of last year, the Board published a report titled Underground Exploration and Testing at Yucca Mountain. In that report, the Board expressed its strong support for the DOE's plan to rapidly construct an underground tunnel to identify and provide access to potentially significant geologic features of the Yucca Mountain site. It has long been the Board's view that the significance of some geologic features, especially those that are nearly vertical, cannot adequately be evaluated using surface-based drilling. This is because there is only a small likelihood that vertical boreholes drilled from the surface will intersect such structures at repository depth. A bored tunnel, however, would cross such features perpendicularly, allowing physical access to them for visual examination and scientific testing at the repository level.

The Board also recommended that the DOE should reinstate its underground thermal-testing program as soon as possible to allow the development of instrumentation and procedures and to gain as much testing experience as possible prior to initiating testing in the core test area. The Fran Ridge large block heater test is a start, but the program currently lacks sufficient field testing experience, proven instrumentation for underground testing, and a well-developed testing strategy. As I noted earlier, a significant issue currently facing the Yucca Mountain project is a research base for determining the most appropriate thermal loading for a repository. A well-developed program of thermal testing is needed to support a thermal-loading decision.

The Board found that the lack of a testing strategy was also evident in other areas of proposed underground testing. The Board recommended that existing plans should be expanded to produce a comprehensive strategy for exploration and testing. Priorities and goals should be based on specific intermediate goals, should be consistent with the scientific needs of site characterization and repository design, and should be consistent with realistic funding expectations.

Finally, the Board found that the DOE's plans for construction of the exploratory studies facility are not consistent with practices in the underground construction industry. The Board recommended development of a more efficient system for managing design and construction of the facility that contains greater accountability and incentives for cost-effective and timely performance of the contractors.

Let me now briefly discuss an issue of more direct concern to the NRC — the NRC's regulatory requirements for the Yucca Mountain repository.

Viewgraph 9

Update of 10 CFR Part 60 Is Needed

- Ground-water travel time criterion needs revision
- Trade-offs between subsystems need clarification

The Board is aware that the Energy Policy Act of 1992 calls for a general review of repository regulatory requirements, including those of the NRC. However, any needed amendments to the NRC's regulation are to follow completion of the reviews by the National Academy of Sciences and the Environmental Protection Agency. Several years could be required to complete those reviews. Meanwhile, the repository program is having difficulty

implementing certain aspects of the NRC's regulations, and some NRC criteria may actually be unnecessary for repository safety.

The most obvious example is the ground-water travel time criterion of § 60.113. The DOE is now conducting studies to estimate ground-water travel time even though many hydrologists do not believe it is a very meaningful indicator of the suitability of the site. At Yucca Mountain, other parameters, such as percolation flux through the unsaturated zone, might be better measures of the waste isolation capabilities of the site.

Another example of less immediate urgency, but possibly of greater significance as the repository design matures, is the provision of § 60.113 that allows alternative numerical goals for the performance of the major subsystems of a repository. It is not clear at what stage in the licensing process the NRC would approve or specify alternative goals, nor is it clear how the NRC would decide what those goals should be.

It has been more than ten years since the NRC's regulation was promulgated. In those areas where there are known problems with the regulations, the Board encourages the NRC to develop needed guidance or amendments now, rather than waiting until completion of the reviews of the National Academy of Sciences and the Environmental Protection Agency.

Viewgraph 10



In summary, the Board expects a number of important decisions to be made, at least in a preliminary way, in the year ahead. These decisions have the potential to significantly move the program forward. In some cases, the Board has reservations about the adequacy of existing information to support decisions, and review of this information base will be a significant area of investigation by the Board during the coming year.

Dr. North and I will be happy to respond to questions.

*Nuclear Waste
Technical Review Board*

*Letter Report
to Congress
and the
Secretary of
Energy*

February 1994

Nuclear Waste Technical Review Board

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UNITED STATES
NUCLEAR WASTE TECHNICAL REVIEW BOARD

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February 24, 1994

The Honorable Thomas S. Foley
Speaker of the House
United States House of Representatives
Washington, D.C. 20515-6501

The Honorable Robert C. Byrd
President Pro Tempore
United States Senate
Washington, D.C. 20510-1902

The Honorable Hazel R. O'Leary
Secretary
U.S. Department of Energy
Washington, D.C. 20585

The Nuclear Waste Technical Review Board issued its *Special Report to Congress and the Secretary of Energy* almost one year ago. Since then, the Department of Energy's (DOE) civilian radioactive waste management program has made progress in many areas. After several delays, underground excavation of the exploratory facility at Yucca Mountain has begun, and the management and operating (M&O) contractor is beginning the integration of the entire civilian radioactive waste management system — including storage, transportation, and disposal. In addition, the Board has been encouraged by Secretary O'Leary's recent efforts to improve the program. Specifically, she has created the position of chief scientist to help integrate important scientific and technical activities at the Yucca Mountain site; she is proceeding with a financial and management review of the Yucca Mountain project in Nevada; and, through a recent initiative, she has taken steps toward broadening stakeholder participation in the civilian radioactive waste management program. Finally, she moved swiftly to find a permanent director for the program. The Secretary's choice for director of the Office of Civilian Radioactive Waste Management (OCRWM), Dr. Daniel Dreyfus, was confirmed by Congress on October 7, 1993.

At the Board's January 1994 meeting in Washington, Dr. Dreyfus made a presentation to the Board on behalf of Secretary O'Leary. During his remarks, he outlined current program goals and indicated he would soon be inviting comments on how to improve the current focus of site-characterization efforts at Yucca Mountain and how to shape the program to accommodate future budget realities. It is apparent that within only a short time, the director and his staff have succeeded in recognizing many of the key issues that need addressing in the coming months. In an effort to provide timely and constructive comments on important programmatic issues, the Board has decided to submit this short letter report, which contains three recommendations.

Summary of the recommendations

At the January meeting, Dr. Dreyfus listed several important short-term goals the OCRWM program had set for itself. These include "returning the emphasis" of the repository program to science and site characterization, "institutionalizing stakeholder interaction," and proposing a new funding mechanism to increase monies going to the OCRWM program; Dr. Dreyfus said that, once the future budget profile of the program had been determined, program activities would be "recast to use those resources efficiently." In light of these program goals, the Board would like to make the following recommendations.

1. The Board repeats the recommendation it made in its *Special Report* in March 1993: *an independent review of the OCRWM's management and organizational structure should be initiated as soon as possible.* The problems created by OCRWM's large and unwieldy organizational structure, as well as by previous management decisions, should be addressed sooner, rather than later. The Board believes that this review can and should be undertaken without slowing the momentum of important site-characterization activities currently under way at Yucca Mountain.

Now that the Secretary has requested the creation of a special fund to give the OCRWM increased access to revenues coming into the Nuclear Waste Fund, an independent review is needed more than ever. This is because relatively too little funding has been going to the direct costs of the scientific research and engineering activities essential to characterizing the Yucca Mountain site. Based on its four-year review of the program, the Board believes that *simply increasing the program's funding will not ensure that adequate funds will be allocated to the most important site-characterization activities or to other critical research.* Simply increasing funding also will not ensure that the program will meet its current schedule deadlines. The Board believes that a timely, independent review of the OCRWM's management and organizational structure will provide an excellent basis for the needed reshaping of the program, regardless of future funding scenarios.

2. The Board believes that it is vital to maintain the momentum of current site-characterization efforts and recommends that, *whether the program budget remains level or is increased, program management should ensure sufficient and reliable funding for site characterization and performance assessment, which is critical for integrating the program.* During the past three years, the OCRWM has cited a lack of funds as the reason for postponing or slowing critical site-characterization activities, including underground excavation and surface-based testing, as well as research in other important areas. At the same time, however, the number of people working on the program has continued to grow. Program managers need to place a greater emphasis on a number of critical activities, including underground excavation, surface-based testing and mapping, thermal testing, and waste package development. At the very least, sufficient monies should be guaranteed for those activities that will facilitate the identification as soon as possible of any obvious features that would disqualify the site.

3. The Board recommends that the OCRWM *build on the Secretary's new public involvement initiative by expanding current efforts to integrate the views of the various stakeholders into the civilian radioactive waste management program during the decision-making process — not afterward.* Because both the lay and the scientific communities have important roles to play in the evolution of this program, the Board hopes that the OCRWM's recent stakeholder workshops are only the first in a series of constructive interactions with OCRWM stakeholders. Furthermore, the Board encourages the DOE to establish a *long-term framework* for constructive interaction with OCRWM stakeholders on important high-level waste management issues.

The following discusses these three recommendations in more detail.

Recommendation 1: Independent Program Review Needed Now More Than Ever

As it did in its March 1993 *Special Report*, the Board recommends that *an independent review of the entire OCRWM's management and organizational structure be undertaken as soon as possible.*¹ The Board believes that the large number of program personnel, the many organizations involved in the U.S. program, and the diffuse nature of its organizational structure will continue to create very difficult challenges for program managers and adversely affect the technical program.

The U.S. civilian radioactive waste management program is proving difficult to manage. It currently employs approximately 2,790 people spread among a dozen major and almost two-dozen minor contractors, several national laboratories, various government agencies, and others.² The program's organizational structure is multilayered, program entities are geographically dispersed, and responsibility for decision making is spread among too many managers. The result is a lack of overall program integration. This contributes to major inefficiencies, which, in turn, affect every aspect of the technical and scientific program and hinder the integration of the program's different scientific and engineering components. Finally, OCRWM management historically has devoted such significant resources to overhead and infrastructure that relatively limited funding has remained for important science and site-characterization activities.³

¹Others (U.S. Representatives Philip Sharp and Richard Lehman in August 1993, and the General Accounting Office in May 1993) have made similar recommendations.

²January 27, 1994. Memo to the Board from the DOE's Office of External Relations, Office of Civilian Radioactive Waste Management. The numbers, which include contractors and approximately 250 federal DOE employees, reflect the number of people working on the OCRWM program as of the first quarter of fiscal year 1994.

³NWTRB. 1993. *Special Report to Congress and the Secretary of Energy*. March 1993. Or, most recently, for example, at the Board's July 1993 meeting the OCRWM attributed its under use of outside expert judgment in a performance assessment study to a lack of sufficient funds.

In the past, the Board has questioned the technical basis for a number of management decisions. For example, at the Yucca Mountain site-characterization project office in Nevada, decisions often do not reflect standard practice in the underground construction industry. The cost-plus award-fee contracts being used encourage neither competition nor innovation.⁴ The Board also believes that the OCRWM is overdesigning the underground exploratory studies facility planned for Yucca Mountain. The excavation of the exploratory facility could be accomplished more quickly and at less cost if the surface and subsurface support facilities and utilities were reduced in scale and simplified.⁵ The Board believes that decisions like these could continue to divert funds from important site-characterization and related research activities, no matter what the OCRWM's budget.⁶

Recently, the Secretary asked Congress to create a "special funding mechanism" that would provide the OCRWM with increased access to monies flowing into the Nuclear Waste Fund.⁷ Given this request, the review recommended by the Board in its March 1993 *Special Report* takes on even greater significance. Although the Board believes that the OCRWM must direct more funding to site characterization, *simply increasing OCRWM's budget will not ensure that adequate funds will be allocated to the most important site-characterization activities or to other critical research and testing; nor will it ensure that the current program schedule is met.*⁸ And simply increasing the program's budget will not solve the OCRWM's significant organizational and management problems, which continue to affect the technical program.

The Board believes that, in addition to helping address the OCRWM's management and organizational problems, an independent management review of the entire OCRWM program would provide program managers with a framework that would allow, for example, (1) better integration of the science and engineering in the program,

⁴Questions about the efficiency of the DOE's award-fee contracts also have been raised by DOE Assistant Secretary Thomas P. Grumbly. (See *Energy Daily*, Monday, July 19, 1993.)

⁵NWTRB. 1993. *Underground Exploration and Testing at Yucca Mountain*. Report to Congress and the Secretary of Energy. October 1993. (See discussion beginning page 13.)

⁶The Board hopes that the constructive organizational changes being made at the Yucca Mountain project in tandem with the financial and management review of the Yucca Mountain project announced by the Secretary on January 27, 1994, will address some of these problems.

⁷When asked by the Office of Management and Budget to comment on the funding mechanism, the Board chose to defer comment to those more competent in such matters.

⁸A number of important activities must take place before repository operations, currently scheduled for 2010, can begin. For example, repository construction should begin around 2001. But before that happens, for example, the DOE must (1) complete the underground exploratory facility (the main portal-to-portal tunnel is not scheduled to begin before August 1994); (2) initiate and secure data from long-term in-situ thermal testing, which is not scheduled to begin until 1997; (3) submit a final environmental impact statement.

(2) more informed judgments about opportunities for reducing the duplication of efforts by multiple contractors, and (3) a restructuring of the program while maintaining the continuity of scientific and technical activities.

Unfortunately, such a broad-based review of the entire OCRWM has neither been initiated, nor, to the best of our knowledge, been planned. As already mentioned, the Secretary has announced a financial and management review of the Yucca Mountain project, and this limited review could play an important initial role in an overall review of the OCRWM program. However, neither this limited review, nor the recently completed selective compilation of comments by parties interested in the repository development program,⁹ would substitute for the kind of independent review called for last year in the Board's *Special Report*.

The Board suggests that the Secretary of Energy appoint a small, independent group of internationally recognized experts with extensive experience in managing large, complex programs and in system acquisition to conduct this review. Although necessary, knowledge in the nuclear waste management field alone would be insufficient to carry out the review. Given these kinds of experts, such a review should not take long, nor require a large staff. The review can and should be conducted *concurrently* with ongoing site-characterization activities.

Recommendation 2: Maintain the Momentum of Site-Characterization Activities

In the past, the Board questioned continual delays in site characterization. Now that excavation activities at the Yucca Mountain site have finally begun, it is crucial that the momentum of these activities be maintained.

In previous reports and in its *Special Report*, the Board expressed concern about the OCRWM's decision to devote such significant resources to overhead and infrastructure that relatively limited funding remains for site-characterization activities. The OCRWM has cited a lack of funds as the reason for postponing or slowing some critical activities, such as underground excavation and surface-based drilling and testing. The Board also recommended in several reports against reducing the funding to support development of a long-lived waste package.¹⁰ While these important scientific and engineering activities were being either postponed or slowed, however, the number of

⁹Thurber, James A. *Draft Report on Published Works and Comments Regarding the Office of Civilian Radioactive Waste Management Program, 1989-1993*. December 13, 1993.

¹⁰In its *Fourth Report* (1991), the Board recommended that engineered barrier development and testing be funded continuously and at a level sufficient to evaluate its contribution to long-term predictions of repository behavior. In its response to that recommendation (in the *Fifth Report*) the DOE indicated its agreement with this recommendation but explained that budget constraints were responsible for the constricted development of engineered barriers. The Board was recently encouraged to see small increases in funding going to research in this area. Waste package design is a critical area, especially in light of recent emphasis by the DOE on the development of a multipurpose canister.

contract employees working on the program continued to grow. For example, since July 1991 the number of contract employees working full time on the program has increased 34 percent to a total of 2,540 in December 1993.¹¹ In addition, substantial resources are being committed to the construction of a complex underground exploratory facility with a very large main tunnel, a large and complex core test area, and surface and subsurface facilities and utilities that exceed the actual requirements of the current excavation plan.¹²

Given these kinds of management decisions, the Board believes that, no matter what OCRWM's future budget, delays in the scientific investigations at the site easily could continue. For example, if underground excavation is delayed or slowed (a real possibility) during fiscal year 1995, the underground exploration needed for identifying any obvious features that could disqualify the site also will be delayed. And initiation of the underground in-situ thermal testing needed to support decisions about repository and waste package design and about repository licensing likewise will be delayed. This is critical because in-situ thermal testing may take a decade or more to complete.¹³

To ensure that the momentum of activities currently under way at Yucca Mountain continues — *whether the budget remains level or is increased* — funds must be allocated in such a way as to ensure sufficient and reliable support for site-characterization and iterative performance assessment, which is essential for focusing the technical program. Program managers need to place a greater emphasis on a number of critical activities, including underground excavation, surface-based testing and mapping, thermal testing, and waste package development. Determining whether or not Yucca Mountain is suitable for locating a permanent high-level waste repository is probably the program's most important short-term goal, and its high priority should be reflected in the allocation of the program's funds.

Recommendation 3: Expand Efforts to Integrate Stakeholder Views

The continuing involvement of stakeholders and other members of the interested public is critical to the progress of the OCRWM's program. The Board has seen — in the U.S. program and in programs in the seven other countries it has visited — that public perceptions about the potential risks associated with nuclear power and the waste it generates must be addressed. Without substantial public involvement, the goal of siting a permanent repository could be even more difficult to achieve, no matter what the sophistication and depth of the technical and scientific program.

¹¹In July 1991, there were 1,890 contract employees working on the program, in addition to approximately 250 federal DOE people. These numbers are available from the OCRWM on a quarterly basis.

¹²NWTRB. 1993. *Underground Exploration and Testing at Yucca Mountain. A Report to Congress and the Secretary of Energy.* October 1993.

¹³NWTRB. 1993. *Special Report to Congress and the Secretary of Energy.* March 1993.

At the January Board meeting, Dr. Dreyfus was asked to comment on the findings of a task force report commissioned by the previous Secretary of Energy, which determined that a "widespread lack of trust in the DOE" exists, "specifically in the waste management office's activities."¹⁴ The report suggests that some of this distrust stems from the DOE's historical exclusion of potential stakeholders from the decision-making process. Dr. Dreyfus responded that one of the Secretary's major goals is to create an environment of openness and interaction with program stakeholders. Indeed, the Secretary already has initiated a new public involvement policy.¹⁵

The Board supports the DOE's efforts to broaden the public's participation in the decision-making process and *recommends that the OCRWM build on the Secretary's initiative by expanding current efforts to integrate the views of the various stakeholders into the civilian radioactive waste management program as it evolves.* The Board believes the views of the interested public must be integrated into the program *while key decisions are being made -- not afterward.* Both the lay and the scientific communities have important roles to play in the evolution of this program. We hope that recent stakeholder workshops¹⁶ are only the beginning of an ongoing series of constructive OCRWM-stakeholder interactions. The Board also encourages the Secretary to consider establishing a long-term framework for constructive interaction on high-level waste issues with OCRWM stakeholders similar to the Environmental Protection Agency's recently completed *year-long* superfund study.¹⁷

In conclusion, the Board recognizes that OCRWM's new program managers are facing a wide variety of significant challenges. The Board also understands that the recommendations it is making will not be easily implemented; there are no quick fixes for this complex program. With that said, however, the Board strongly believes that, no matter what future funding trends may be, these recommendations should be implemented to achieve an efficient and cost-effective program. We hope that the

¹⁴*Earning Public Trust and Confidence: Requisites for Managing Radioactive Waste, 1993. Final Report of the Secretary of Energy Advisory Board Task Force on Radioactive Waste Management. November 1993.*

¹⁵*On December 17, 1993, the Department of Energy released for public comment a draft of its new public involvement policy.*

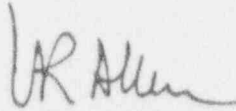
¹⁶*The OCRWM has held four stakeholder workshops in recent months on general issues, the multipurpose canister, and on the waste management system.*

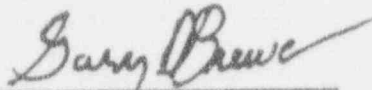
¹⁷*In June 1993, the DOE participated in a Keystone-led effort to hammer out consensus on high-level waste. Unfortunately, the effort died after the first meeting. Recently, a similar effort was undertaken by the EPA to look at ways of revamping procedures to clean up hazardous waste dumps across the United States. The results of this year-long study of the superfund program by environmentalists, industry leaders, Indian tribal leaders, and others included consensus on a number of issues and several wide-ranging recommendations for program improvement.*

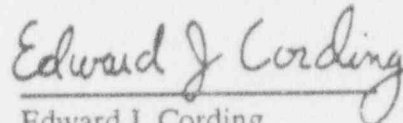
Congress and the Secretary of Energy will consider our recommendations seriously as important decisions are being made about the funding structure of this vital national program.

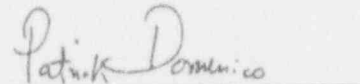
Sincerely,

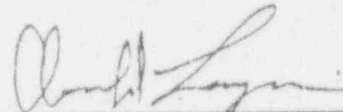

John E. Cantlon, Chairman

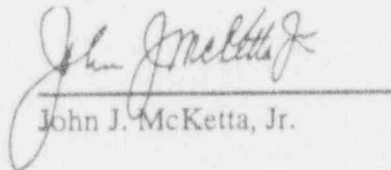

Clarence R. Allen

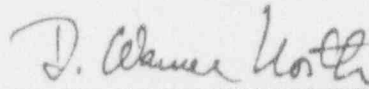

Garry D. Brewer

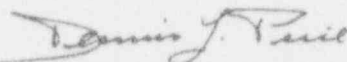

Edward J. Cording

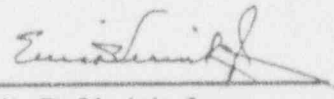

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