

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

**Title: DOE BRIEFING ON STATUS OF HIGH LEVEL
WASTE PROGRAM - PUBLIC MEETING**

Location: Rockville, Maryland

Date: Monday, December 19, 1994

Pages: 1 - 50

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12 Nuclear Regulatory Commission
13 One White Flint North
14 Rockville, Maryland
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16 Monday, December 19, 1994
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18 The Commission met in open session, pursuant to
19 notice, at 10:00 a.m., Ivan Selin, Chairman, presiding.
20

21 COMMISSIONERS PRESENT:

22 IVAN SELIN, Chairman of the Commission
23 KENNETH C. ROGERS, Commissioner
24 E. GAIL de PLANQUE, Commissioner
25

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1 STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

2

3 KAREN D. CYR, General Counsel

4 JOHN C. HOYLE, Acting Secretary

5 DANIEL A. DREYFUS, Director, Office of Civilian Radioactive
6 Waste Management, DOE

7 LAKE H. BARRETT, Deputy Director, Office of Civilian
8 Radioactive Waste Management, DOE

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P R O C E E D I N G S

[10:00 a.m.]

CHAIRMAN SELIN: Good morning, ladies and gentlemen.

The Commission is meeting today to receive our periodic briefing from the Director of the Office of Civilian Radioactive Waste Management, Department of Energy, Dr. Dan Dreyfus. We were last briefed by Dr. Dreyfus on the High Level Waste Program in June of this year and since that briefing the Department has begun to implement the program approach which anticipates making a site suitability determination for the proposed site at Yucca Mountain, Nevada in fiscal year 1998. Assuming that the site is determined to be suitable, applying for license to construct a repository by 2001.

As part of the program approach, DOE has initiated interactions with the staff on an ambitious program to certify several multipurpose canister designs for spent fuel storage and transportation purposes.

In presentations to the Commission, the staff and other groups, such as the Nuclear Waste Technical Review Board and the NRC Advisory Committee on Nuclear Waste, have expressed a number of concerns about the program approach, probably due to a lack of detailed information. In addition, the Commission raised several questions on aspects

1 of the DOE's program in our November 23rd letter to Dr.
2 Dreyfus. These obviously will be large topics of interest
3 today.

4 I have to admit that I peeked at your statement
5 and you do seem to address most of these in a good, head-
6 on, direct, to be complemented fashion.

7 So, Commissioner Rogers?

8 COMMISSIONER ROGERS: Nothing.

9 CHAIRMAN SELIN: Commissioner de Planque?

10 We are rapt auditors of your presentation this
11 morning.

12 DR. DREYFUS: Thank you, Chairman Selin, members
13 of the Commission.

14 I'm pleased to be here again to brief you on the
15 status of the Civilian Radioactive Waste Management Program
16 in these very interesting times.

17 In my first briefing to you last December, I
18 reported on our evaluation of the need for improving the
19 program. In the briefing last June, I outlined what we then
20 referred to as the proposed program approach and our plans
21 to address the issues of waste acceptance, storage and
22 transportation as well. I stated then that to achieve our
23 objectives we had to have the approval of the Administration
24 and the Congress for a funding profile that would support
25 the program approach. In addition, I informed you of the

1 need for support of your staff in reviewing many documents
2 that we would be submitting.

3 My prepared statement provides a review of
4 progress in '94, plans for '95 and, in addition, addresses a
5 number of specific current issues. My summary remarks, I
6 will just highlight some of the progress and plans and the
7 more important of our views on the issues that I believe are
8 the ones of particular interest to the Commission.

9 As has been the custom, I would like to begin with
10 just a few pictures to give the narrative a sense of
11 reality.

12 [Slide]

13 DR. DREYFUS: The tunnel boring machine has been
14 delivered, has been assembled and placed in a starter
15 tunnel. We have been resolving a succession of testing and
16 start-up problems.

17 [Slide]

18 DR. DREYFUS: There is a picture of the operator
19 at work and the machine has operated.

20 [Slide]

21 DR. DREYFUS: We have a picture of muck being
22 discharged from the muck cars, which I will wait.

23 CHAIRMAN SELIN: It certain looks like muck.

24 DR. DREYFUS: It certainly does. Now, we expect
25 to be in production operation early next year. We have been

1 resolving problems as they arise, as is usually the case
2 with the beginning of this kind of an operation. It's
3 important, I think, to avoid a preoccupation with the tunnel
4 machine. It's big and it's interesting, but it's only one
5 aspect of a complex ongoing effort.

6 [Slide]

7 DR. DREYFUS: There is one more picture that I
8 want to show simply to illustrate that we are doing other
9 things as well. This is a seismic reflection blast and is
10 part of the ongoing surface scientific activities that we
11 are doing at the site. Those are also making progress.

12 Probably our most important accomplishment in 1994
13 and the key to the progress in the future has been the
14 increased level of financial support that was provided by
15 the Administration and the Congress. The Congress acting in
16 its belief that we can and will achieve the objectives
17 agreed to went along with the Administration's proposed 40
18 percent increase in funding for fiscal year '95, despite
19 severe government-wide budgetary restrictions.

20 [Slide]

21 DR. DREYFUS: Most of the additional funding, as
22 you can see from this graph, has been allocated to the Yucca
23 Mountain site characterization program. The red portion of
24 the graph is the Yucca Mountain activity. I'm hopeful that
25 the future funding profile that is shown there and which was

1 proposed with our FY '95 budget can be obtained, although I
2 think we must expect from current conversation and previous
3 intention that there is going to be additional deficit
4 reduction preoccupations in the years ahead government-
5 wide.

6 We also completed development of the new program
7 approach consistent with the funding that we requested. I'm
8 aware of the discomfort the Commission staff has had with
9 the rapid change in our approach and your desire for greater
10 specificity about our plans as a part of my report today.

11 We have been engaged in extensive replanning
12 decision. It has involved collaboration with external
13 parties and, of course, the need for congressional guidance
14 on the budget. We have only recently been able to document
15 the results of those decisions. We have now provided your
16 staff with the reports that I have brought along, again to
17 give some reality to the words and there are on that table
18 the Advanced Conceptual Design Report, a Total System
19 Performance Assessment '93, technical implementation plans
20 and a paper on the process for site suitability evaluation.

21 In addition to these documents which the staff
22 has, I have brought with me today advanced copies of our
23 program plan, Volumes 1, 2 and 3, which will be released
24 soon. That plan is intended to summarize in reasonably
25 cogent and concise form the full spectrum of where we expect

1 to be going with this program from now on.

2 Additional documentation and briefings will, of
3 course, be forthcoming. Details of the program changes will
4 be included in the 12th Semiannual Progress Report on Site
5 Characterization which will be provided to the Commission in
6 June of '95 and, of course, in subsequent progress reports.

7 In 1994, with regard to waste acceptance, storage
8 and transportation, we issued a request for proposal for the
9 design of the multipurpose canister subsystem. We have also
10 initiated recently the scoping by the environmental impact
11 statement necessary to support a decision on fabrication and
12 deployment of that system.

13 I gave you my assurance last time that we
14 recognized that the licensing support system, or LSS, is
15 indispensable to your acceptance and review of the license
16 application. We remain committed to developing the system
17 in a timely and cost effective manner. This year we
18 chartered a working group to examine the LSS development
19 strategy. The working group has completed a draft report
20 summarizing its findings. We have been keeping the LSS
21 administrator and the Advisory Review Panel informed and we
22 met with them most recently on December 12th and 13th. I
23 have assigned a high priority to assuring that the resources
24 will be made available for timely implementation of the
25 system.

1 CHAIRMAN SELIN: I should mention that the reports
2 from that meeting were uniformly positive. It seems that
3 decisions are being made in the right order, that you still
4 have some options, but that it's likely that we'll be
5 satisfied whichever of the options you choose to process.

6 DR. DREYFUS: Yes, sir. I believe they're
7 administrative questions rather than substantive --

8 CHAIRMAN SELIN: Basically the overall structure
9 is just much more sensible than it was six months or a year
10 ago. That seems to be very positive.

11 DR. DREYFUS: I'm glad. Thank you.

12 Our repository investigation plans for '95 are
13 ambitious and they include preparing technical and
14 compliance documentation to support decisions on five higher
15 level findings relating to guideline conditions for surface
16 processes. We will also begin the formal NEPA process for
17 the repository by initiating scoping activities to the EIS.
18 We will continue construction activities for the exploratory
19 studies facility. We will submit responses to the staff's
20 questions and comments about our topical report on extreme
21 erosion and we will submit the second of a series of three
22 topical reports on the seismic hazard situation.

23 In the waste acceptance storage and transportation
24 area, we will concentrate on the MPC design and on
25 compliance with the requirements of NEPA. In April we

1 expect to complete our evaluation and proposals received and
2 award one or more contracts for the design of MPC.

3 In May we plan to complete and submit to the
4 Commission a topical report that will provide the basis for
5 your consideration of our use of partial burn-up credit and
6 special cask loading procedures for storage and
7 transportation. We expect to interact with your staff
8 frequently on all aspects of that.

9 Now, in my prepared statement I've addressed a
10 number of important issues that we're dealing with,
11 including those that were mentioned in your letter to me of
12 November 23rd. As I have stated before, our previous
13 approach in determining site suitability was simply no
14 longer supportable. There was no possibility that it would
15 be funded at the required level. It did not provide targets
16 for early convergence of the scientific activities and it
17 did not provide adequate means for measuring annual cost and
18 progress against a meaningful path to convergence. The
19 issue was not if a new approach is needed, but whether one
20 could be found that would accomplish the objectives of the
21 Nuclear Waste Policy Act within practical resource
22 limitations and schedules.

23 We believe that the new program approach can
24 achieve those objectives and nothing that's been going on in
25 the last year or especially in the last few weeks has led me

1 to believe that we under estimated our prospects for funding
2 or that anymore leisurely schedule would be welcome by our
3 stakeholders.

4 We must now establish confidence that our new
5 approach can meet the regulatory requirements. We know our
6 responsibilities in this regard and we take them very
7 seriously. The new approach initially focuses the site
8 characterization activities on what we call a technical site
9 suitability determination, which we expect to make in '98.

10 There's been some concern expressed about the
11 intention of this new milestone both by the Commission staff
12 and by other reviewers of the program. It is a management
13 tool to facilitate program planning, to reach logical
14 convergence on the scientific program, to establish
15 priorities and to allocate resources. It will also enable
16 the director to respond more substantively at an earlier
17 date to questions about the probable adequacy of the site
18 from a technical point of view. It is not a secretarial
19 action or a final agency action and it does not preempt or
20 replace any regulatory determinations.

21 We're also sensitive to your concerns that
22 reliance on bounding analyses might lead to excessive
23 conservatism. We do believe that in a number of areas --

24 CHAIRMAN SELIN: Let me just stop you. It's not
25 the conservatism we're concerned about, it's the then coming

1 back in and saying, "Since this is so conservative, we can
2 cut it back and then we don't know whether we're on the left
3 or the right of the boundary."

4 DR. DREYFUS: Yes. I recognize that nuance and I
5 read it --

6 CHAIRMAN SELIN: Fair enough.

7 DR. DREYFUS: -- in your comments in a transcript
8 of your interview with the staff. We do believe that right
9 now in a number of areas our performance assessments are
10 exhibiting extreme conservatism. Certainly in the area of
11 the waste package and waste solution, we have piled one upon
12 another of conservative estimates, simplifying bounding
13 conservative estimates.

14 As we proceed, we'll be evaluating the
15 consequences of those estimates in performance assessments.
16 The ultimate balance between the use of conservative
17 bounding analyses and the reduction in uncertainty that can
18 be obtained with further data gathering and analytical
19 effort is something that we will have to refine as we go
20 along in an iterative manner and gain better understanding
21 of system performance.

22 I want to correct any impression our site
23 investigations will stop in 1998 when we make the technical
24 site suitability determination. After that we will be
25 continuing to conduct additional tests and performing

1 additional analyses that are required for both the EIS and
2 the license application. We will conduct all of the
3 investigations required to implement the performance
4 confirmation program.

5 CHAIRMAN SELIN: Well, if it's any solace to you,
6 Dr. Dreyfus, our concern is now the other side, that you're
7 going to come in with an application before you have enough
8 data to support it and that, in fact, you will be continuing
9 to gather data to the point where we're concerned about what
10 the status of the original application turned out. So, you
11 satisfied us on one side, but now we're concerned probably
12 with the other one.

13 DR. DREYFUS: I think the entire process is a
14 balancing act in many respects, but I think it needs to be
15 in any area which clearly one could collect data forever and
16 we will be working on that.

17 Now, the current program approach continues to
18 comply with the Department's siting guidelines and the
19 Commissions regulations.

20 [Slide]

21 DR. DREYFUS: Shown on a schematic visual that we
22 have, both require explicit consideration and capabilities
23 of the natural system as well as engineered systems. Our
24 approach is consistent with the Commission's defense in
25 depth philosophy.

1 The waste isolation strategy embodied in the
2 program approach remains fundamentally the same as that in
3 the Department's 1988 site characterization plan. It relies
4 on a natural barrier with low liquid saturation and low
5 aqueous flux. It relies on engineered barriers which limit
6 the release of radionuclides. The current approach differs
7 in respects and are the direct result of the adoption of a
8 multipurpose canister development and a more advanced
9 understanding of the probable near field environment for the
10 waste package.

11 The waste disposal concept we're developing calls
12 for in-drift emplacement of large robust multibarrier waste
13 packages in a repository. The concept is explained in our
14 initial summary report for repository waste package advanced
15 conceptual design. We have not at this time progressed to
16 the point where we can decide on a design thermal load. We
17 therefore plan to develop a design for the repository and
18 the waste package, including the multipurpose canister, that
19 is flexible.

20 Consistent with this strategy, our technical site
21 suitability determination in 1998, our EIS in the year 2000
22 and the license application we plan to submit in 2001 are
23 likely to be based on design consistent with a low range
24 thermal loading. We will include evaluation of the
25 sensitivity of that determination to a range of thermal

1 loadings. We'll continue long-term in situ heater tests and
2 we'll propose higher thermal loads in an updated application
3 if the additional data supports the approach. The only
4 alternative we would have would be to delay the EIS, the
5 design and the initial license application until multi-year
6 in situ thermal loading studies can be completed. That
7 approach would add a decade at least to the target date for
8 the license application.

9 CHAIRMAN SELIN: I need to stop you for a moment.
10 This is, in my opinion, by far the most significant issue
11 that we have to address in your presentation, in large
12 because you've done quite a good job at addressing some of
13 the other issues. I might start with a kind of an apologia
14 that we didn't like the other approach, but we were
15 comfortable with it. So, when you bring in something new,
16 there's a certain amount of getting to know, et cetera, and
17 this might sound a little bit like just quibbles. But we
18 have in mind that when you submit your application you're
19 ready to build that facility and, sure, during the time
20 you're going to do confirmatory data, but the expectation is
21 that that application is what you intend to build unless it
22 turns out to prove infeasible. We have the impression that
23 that's not the current situation.

24 In fact -- well, a couple parts. Number one,
25 you'd prefer to build a high temperature rather than a low

1 temperature loading, but you don't have enough data to
2 support the application. So, the question arises, and there
3 will be a lot of work in the next couple years, what is the
4 meaning of an application, which sounds like it's your
5 backup, not your most desired piece.

6 The second, which is for you to answer but we
7 still have to understand, is how much effort and time does
8 it pay for us to put in on an application which is not
9 likely to be the ultimate one? The third is are you so sure
10 that the low temperature loading one is a lower risk one
11 than the higher volume? The implication is you have enough
12 information to support the low loading application, but not
13 the high loading application at the time as if the low
14 thermal loading is the low risk approach and a high thermal
15 loading -- I'm sorry. A low uncertainty approach, and a
16 high thermal loading is a higher uncertainty approach.
17 That's a new concept that really hasn't been developed.

18 So, we are, at the very least, uncomfortable
19 because the approach is not only so different from the
20 previous approach just in the sense of what are you applying
21 for, I'm not talking about the management approach which is
22 clearly better, et cetera, and it's also very different from
23 the way we're used to doing licensing. If anything, sorry
24 to bring in this analogy, but it is the way we think, in
25 Part 52 we're going the other way. We're trying to get sort

1 of everything answered before even the construction
2 application comes in. Here the application seems on first
3 blush to predate a lot of the information that will be
4 necessary not only the process the application but for you
5 to make fundamental design decisions which won't really have
6 been made at the time of the application.

7 I don't think we expect you to come up with a
8 definitive answer, but you should understand that this is a
9 serious concern beyond the social concern of how our GG-13
10 well react if he or she doesn't agree with the findings of
11 the entire National Science Academy of Sciences when the
12 application comes in. This is a big deal. It's something
13 we need to talk about today and thereafter.

14 So, is it convenient for you to address this
15 point? Would you like to do it in some other --

16 DR. DREYFUS: No. I think it's probably to
17 whatever extent that you'd care to address. I agree it is
18 probably the key issue in the new approach to the analyses.

19 First of all, I think it's not possible to be
20 certain that that is the easiest way to go. It is certainly
21 true that a low thermal loading is closer to the ambient
22 conditions. We will have a lot of information about the
23 ambient conditions at the outset. We will be gathering
24 further information on the impact of the thermal load on the
25 mountain as we go along. Therefore, we will have a better

1 understanding of the perturbations that we get from the heat
2 later.

3 Based on that, we think we can make a compelling
4 argument on the low thermal loading. It is true we prefer
5 the higher thermal loading, if for no other reason that it
6 assures that we have the capacity that we seek in the
7 repository. But on the other hand, we would be applying in
8 the low thermal loading case for a manageable, operational
9 repository, not a fictional repository and it would truly be
10 the requirement to increase, to justify the increased
11 thermal load and therefore the increased concentration of
12 loading as we go along.

13 Now, I think there is one aspect of this that
14 psychologically we've all got to understand and that is that
15 unlike an engineered facility someplace, a reactor for
16 example in which the predominant portion of the undertaking
17 is engineered and can be known in advanced, or at least can
18 be stipulated in advance and then carried out.

19 A very big part of this defense in depth has to do
20 with geologic setting, which is not stipulated in advance.
21 I mean we do not have as-built drawings of the mountain with
22 appropriate QA and we never will. We will be finding out as
23 we build this repository things that one building a reactor
24 would not wish to be finding out as you went along. I
25 presume we'll be working with specified materials and we're

1 working with as-found materials to a very great extent. So,
2 this is not inconsistent with a lot of what we're going to
3 have to do in this undertaking in terms of accommodating to
4 the situation as we understand it. We're looking at
5 essentially 100 miles of additional drifts, more or less,
6 which will certainly turn up an immense amount of
7 underground data that we will not have a license application
8 because those will be done as a part of construction. It's
9 very unlikely that in any normal kind of undertaking you'd
10 have that much data coming in during construction.

11 CHAIRMAN SELIN: That's not the problem. We agree
12 that once there's an application the confirmatory period is
13 very useful because a lot of things won't be known until you
14 get into construction. But that's not the same as applying
15 an application, correct and complete as it may be, for a
16 concept which is different from the one that you hope you
17 will be able to get to during the period. It's this kind of
18 a two goal application that's new and we're just having
19 trouble struggling with it.

20 DR. DREYFUS: I think that's true. I think that
21 basically the implication here is that the second decision
22 is probably a more important decision than it was previously
23 expected to be. I think you had that built into your
24 regulations that there would be a substantive and important
25 decision to be made.

1 CHAIRMAN SELIN: I should say on the positive part
2 that if that's your intention, then we will try to, even if
3 it requires rule changes on our part, to accommodate our
4 process to your intention. But I'm not sure what -- we're
5 trying to figure out what that means for our process.
6 Certainly our rule and our preparation was not designed for
7 the process that you have in mind. Obviously we're going to
8 have to check the statute to see what we can do within the
9 statute, but we're not going to try to constrain you to a
10 particular approach because we happen to have written a rule
11 that way. But we need to understand really what benefit you
12 see in coming in with an application which you're likely to
13 change, what kind of processing makes sense that's what I'll
14 call robust on thermal loading so it's not going to be
15 wasted time when and if you do change. You can see the -- I
16 think you can see the quandary that we're in at this point.

17 DR. DREYFUS: Yes. I think this requires a fair
18 amount of interchange which has begun. We are having these
19 dialogues with your staff and it will take time to create a
20 complete understanding on both sides as to how this works.
21 I don't anticipate that the notion that the first
22 application would be so different from the final one that
23 there would be essentially an exercise in futility if we
24 switched.

25 CHAIRMAN SELIN: I think we're going to ask you to

1 do an outline of the final one, even if it's going to have
2 larger amounts of bracketed areas, so we could not just take
3 that on faith.

4 DR. DREYFUS: Well, we will be designing across
5 range. In other words, the critical elements of this
6 application, design and it will, of course, accommodate the
7 full range. But we will offer a better case for the low --

8 CHAIRMAN SELIN: We may actually ask you, just
9 say, "Making some guesses as to what the answer is, what
10 would an application for a high thermal loading facility
11 look like and how would that be different from --?

12 DR. DREYFUS: Well, that's the intention that that
13 would be a --

14 CHAIRMAN SELIN: You're not foreseeing putting any
15 hot material into the ground during the application, are
16 you? This is all non-nuclear thermal tests that you're
17 going --

18 DR. DREYFUS: Oh, no. That's right. No, there's
19 no nuclear material put in.

20 COMMISSIONER ROGERS: Well, just a couple of
21 points on this.

22 One, just I wonder if you comment on whether the
23 low thermal loading is really that low. It's true you're
24 closer to the --

25 DR. DREYFUS: Everything is relative and it's no

1 low thermal loading. It's hot in the repository but not as
2 hot.

3 COMMISSIONER ROGERS: Right. And therefore one
4 would expect considerable effect on the media, of the
5 thermal effects on the media in even in the low thermal
6 loading case and whether in a sense, and I'm certainly no
7 expert in this area but I'm just recalling what I've heard
8 from some of the other experts, that in the high thermal
9 loading situation you really markedly control the system by
10 the thermal properties much more than the intrinsic
11 properties, the ambient properties of the site, that you're
12 operating at a much higher temperature and therefore effects
13 come in that will change the media itself and change how the
14 whole site behaves. So, that design is really one which is
15 much more dependent upon what those thermal effects really
16 are relative to the ambient conditions when there's no heat
17 in the media at all.

18 So, it's really quite a different situation and
19 that one may not be able to progress in a monotonic fashion
20 from low thermal loading to a projection of how the system
21 would behave in a high thermal loading case. That's a
22 really different situation. And whether the same kinds of
23 information that are important for a low thermal loading
24 design with respect to the ambient properties of the media
25 are as relevant in the high thermal loading cases as they

1 are in the low thermal loading case.

2 You see what I'm saying?

3 DR. DREYFUS: Yes.

4 COMMISSIONER ROGERS: That you've really got two
5 different regimes and that the kinds of studies that you do
6 for one might be really much more important for that rather
7 than for the other regime. So, it's really kind of a
8 complex situation there.

9 I guess the concern that I have is how our staff
10 is going to be able to deal with those kinds of issues
11 because, as has been pointed out to us, the number of
12 parameters is an exponential function in this business so
13 that if you have three choices and ten parameters you've got
14 3^{10} possibilities and that's more than we can handle.

15 So, our staff is concerned about trying to be able
16 to deal with an application that is limited to what's really
17 contemplated rather than a range of various possibilities,
18 each one of which requires an enormous increase in our
19 analysis of the application. So, that's a very serious
20 concern on the part of the staff with respect to the
21 resources.

22 So, I think we have to keep that very much in mind
23 as -- it's nice to have the flexibility to think of
24 different models and so on and so forth, but then each one
25 of these, if they are a possibility, have to be analyzed by

1 the staff. That's starting to get into a very, very big
2 process that we find it difficult to contemplate.

3 DR. DREYFUS: Well, we'll have to support a
4 flexible design with sufficient information to deal with the
5 range. Essentially the two considerations are the
6 environment within which the waste package is functioning,
7 which is largely a question of corrosion of the waste
8 package and that changes with the heat situation because of
9 both the temperature and as well what happens in an
10 unsaturated -- the near field unsaturated moisture
11 recycling, that sort of thing. That is where the behavior
12 under heat requires additional information. It's not clear
13 that that can't be accommodated because it's basically a
14 bounding circumstance on a corrosion effect and we have done
15 performance studies of that and I think we can deal with it.

16 The other consideration has to do with the
17 mechanical and chemical properties of the reasonably near
18 field rock under a higher heat load, which is an
19 imponderable we could use some more information on. The
20 total function of the mountain is more a question of the
21 total amount of material in it and is not really that much a
22 matter of whether or not we load the repository intensively
23 or don't. It's total load kind of a consideration.

24 So, there is a logical way to approach this and in
25 many cases the differences may not be that important. If

1 you'd like to pursue it a little further, I would ask Mr.
2 Brocoum to say a few words about the notion of a flexible
3 design and bounding conditions before I get into the risk of
4 telling you more than I know.

5 COMMISSIONER ROGERS: Well, I think the real issue
6 for us right now is how many situations are we going to be
7 confronted with that we have to analyze and what's going to
8 be the work load on our staff in being able to deal with
9 those, and try to keep that down to something that's
10 manageable, and how soon you'll be able to know what the
11 answer to that question will be?

12 DR. DREYFUS: Why don't I ask Mr. Brocoum to say a
13 few words about this because he may be much more able to
14 articulate it than I am.

15 MR. BROCOUM: Steve Brocoum of Yucca Mountain
16 Project Office, Suitability in Licensing Assistant Manager.

17 There's a lot of questions that have been asked
18 here on this and let me see if I can just cover some of
19 them.

20 There's a lot of factors that come into this.
21 From the PA perspective, PA people tell us the closer we are
22 to ambient, from their perspective, the easier it is to
23 demonstrate the performance.

24 From the engineering perspective, the engineers
25 say, "Well, the hotter it is, the more efficient. The less

1 air you need, the cheaper," and so on.

2 From the theoretical perspective, it seems that if
3 you keep it very hot and you keep the water away, you can
4 get a lot of advantages to building the -- you know, in
5 terms of keeping the packages from corroding or having any
6 source of moving radionuclides.

7 From the site characterization perspective though,
8 you have to characterize environment that's very hot. You
9 have to worry about coupled processes, the interaction of
10 water, geochemistry, phase changes, the materials fracturing
11 and so on. Most of the data we've collected to date has
12 been on more or less the ambient conditions.

13 So, these are the various different factors that
14 need to be considered and trying to balance these all
15 correctly. We feel now that the best -- in the time frame
16 of around 2001, the best license application we can put
17 together will be one where we will make the case for as hot
18 a repository as we can, but our feeling is that will tend to
19 be in the lower end of thermal ranges we're considering.
20 But we intend to make it a complete license application and
21 you will be prepared to go forward with that license
22 application and construction if for some reason we cannot
23 justify, say, an increase in the thermal loading because we
24 can't understand, for example, a couple processes given the
25 kind of information we're getting.

1 These are some of the various considerations that
2 surround this issue. It's a very complicated issue and
3 there is no simple answer. To be honest, there's a lot of
4 debate within the technical staff and there's no full
5 agreement on this.

6 COMMISSIONER ROGERS: I guess we just have to stay
7 posted, that's all.

8 COMMISSIONER de PLANQUE: I have a practical
9 question. If you wind up with a repository that's based on
10 the low thermal loading, I understand one of the
11 ramifications is the capacity. How much of a difference in
12 the capacity would you have between that and what you would
13 really like to do if you had the option?

14 DR. DREYFUS: Well, of course, that depends on
15 characterizing the site. We don't know how much capacity we
16 have under either loading condition until we get further
17 down the road on that. But it could curtail the capacity
18 considerably unless we --

19 COMMISSIONER de PLANQUE: Is there any possibility
20 that you'd wind up with less capacity than what you'd need
21 for all the spent fuel for all the current generations of
22 reactors in their lifetime?

23 DR. DREYFUS: Yes, there is. There is in any
24 case, hot or cold.

25 COMMISSIONER de PLANQUE: Okay.

1 CHAIRMAN SELIN: Having put all these questions to
2 bed, we invite you to continue with the presentation. We'll
3 come back to these in your wrap-up.

4 DR. DREYFUS: I'll try to be relatively brief and
5 just catch a few more that are interesting.

6 Repository strategy is closely coupled to the work
7 we're doing to develop the MPC. The MPC design
8 specification incorporate provisions for satisfying your
9 transportation and storage requirements and for
10 compatibility with your disposal requirements to the extent
11 that we can apply them at this time. We will be comparing
12 the design of the MPC with the maturing repository and waste
13 package designs regularly.

14 We plan to complete the waste package Title I
15 design in 1997 which is prior to any commitment to fabricate
16 and deploy the MPCs. Now, there is a link there that I
17 think resolves questions of making untoward commitments.

18 I would like to point out that over the past six
19 months our activities have increased and the interactions
20 with your staff has intensified. I have submitted a list of
21 20 meetings that we have had with your staff and the ACNW
22 since my last appearance here in June and I think that list
23 makes the point rather forcefully. We're not only dealing
24 with issues, we're developing a new working relationship.
25 On December 6th, your staff suggested that we rely more on

1 the license application annotated outline as a vehicle for
2 submission of updated information and restrict the use of
3 topical reports to generic topics. We are intending to
4 adopt that suggestion.

5 We'll continue to cultivate a working relationship
6 that provides your staff with the information it needs to
7 evaluate and comment on the suitability of our work for
8 inclusion in the license application and also to support the
9 Commission's participation in the recommendation of a site
10 to the President.

11 I would like to comment briefly on the involvement
12 we have with the National Academy of Sciences to manage the
13 peer review of technical basis reports. Peer review is
14 intended to satisfy ourselves and the stakeholders that the
15 scientific work provides a sound technical basis for
16 decision making.

17 [Slide]

18 DR. DREYFUS: The peer review process is
19 explicitly intended to address five questions and I think
20 they're up there, the five questions that are shown on the
21 visual. I think it's clear that those are questions that
22 relate entirely to scientific methodology and the relevant
23 use of data. Peer review is not intended to inhibit your
24 staff from making its own contributions to the review
25 process and certainly the Academy cannot and is not asked to

1 make regulatory judgments. We will be developing
2 information for your review and guidance to us on a regular
3 basis and the Commission's involvement will be continuous.

4 CHAIRMAN SELIN: This is a dynamite slide. If
5 that's, in fact, what they're doing --

6 DR. DREYFUS: That's right out of the specs for
7 the review. So, I think that does make --

8 I have addressed your staff's concerns about the
9 quality assurance program for ESF design control in my
10 statement. On November 14th, we provided to your staff the
11 detailed responses to its comments, questions and
12 recommendations. We also made commitments that we trust are
13 responsive to your concerns. We are continuing ESF
14 construction activities, but subject to a hold that we have
15 placed on tunneling beyond the upper paintbrush tuff non-
16 welded zone contact until we can collect the baseline
17 pneumatic data from several pressure fronts. That data
18 collection is now a high priority activity and we believe
19 that that will resolve questions of losing baseline data on
20 pneumatic activity.

21 The criticality control policy that will be
22 ultimately imposed on canister design and certification is
23 important for the development both of the MPC subsystem and
24 the waste package. The authorization's useful burn-up
25 credit designs will permit a very significant cost saving

1 throughout the system.

2 In response to your staff's recent suggestions,
3 our current approach to criticality control involves using
4 partial burn-up credit to take into account reduced
5 reactivity of spent nuclear fuel and a combination of
6 currently accepted design features. Our initial approach to
7 waste package design will assume the use of the MPC. An
8 important goal is a canister that can be loaded and sealed
9 at a reactor site and normally not opened again. Our
10 approach includes special cask loading procedures that
11 require making measurements to verify the burn-up records of
12 the spent fuel assemblies.

13 [Slide]

14 DR. DREYFUS: I have a visual aid that shows a
15 device for doing that, which I will not try to explain.

16 CHAIRMAN SELIN: It is visual.

17 DR. DREYFUS: Yes, right. We plan to submit a
18 topical report to your Storage and Transportation System
19 Branch in May of '95 for your acceptance of the partial
20 burn-up credit approach, including the cask loading
21 procedures. Later in '95 we plan to define the tests and
22 experiments to provide a basis for the use of full burn-up
23 credit for storage, transportation and in a repository.

24 My prepared statement covers a lot of ground.
25 I've tried to brief you on the status of the program,

1 address your current concerns substantively. The message I
2 want to leave with you is that we do have to communicate
3 better. I think we have both said so already. The staff
4 interactions we are now having are the best avenue for that.
5 I expect them to be very frequent in the future. In the
6 coming year, we also will be concerned with implementing our
7 new management structure, fleshing out the program approach
8 and also obviously with important policy issues. These will
9 likely include congressional action on near-term management
10 of spent fuel, the constraints currently imposed on the use
11 of the Nuclear Waste Fund, the need for a contingency plan
12 should the Yucca Mountain site prove unacceptable and
13 perhaps other issues as well.

14 I'm sure that the Commission is going to be
15 involved in those discussions, not only with regard to our
16 technical program but also with what may prove to be a
17 national review of policy issues. I look forward to our
18 continued participation.

19 That, I think, is the highlights and I'm prepared
20 to address whatever you wish.

21 CHAIRMAN SELIN: It's a dynamite statement, very
22 good statement. It really covers all the topics. Although
23 we may have some concerns about what the answers are, I
24 think it's a legitimate and generally successful attempt to
25 come to grips with our concerns.

1 I have one sort of left field question to ask you
2 before we come back to this. What is the state of your
3 communications with the State of Nevada on the program
4 approach? How are you dealing with them and can you sort of
5 summarize where you stand there?

6 DR. DREYFUS: Well, of course, the State of Nevada
7 is intimately in our day to day business. They have been
8 attending all of the Technical Review Board and all of the
9 Commission interchanges and so they are fully informed of
10 our dialogue with your staff and they, of course, see us
11 regularly independently. So, I believe that the State of
12 Nevada is fully informed and have been involved in the
13 dialogue that led to the adoption of the approach. They
14 have some of the same considerations that the Commission has
15 as to adjusting their participatory functions.

16 CHAIRMAN SELIN: Do they have any other
17 considerations? Have they raised any issues other than the
18 ones that we've raised here that have been addressed in your
19 statement?

20 DR. DREYFUS: Well, I don't like to characterize
21 the state's views on anything because down that road I can
22 get in trouble. So, I would certainly not want to say that
23 I can tell you everything they're concerned with. They have
24 concerns about the conformity of the way we are going with
25 the regulations that are on the street and the question of

1 whether or not the regs need to be changed. They are
2 concerned with the peer review process and have objected to
3 it not so much in the same vein as the Commission but more
4 that it is a closed process at one point because the Academy
5 does indeed hold executive meetings and that that's an
6 appropriate program of this type.

7 They are seeking ways to participate in the site
8 suitability determination which causes a concept that I
9 think has been articulated lately. I'm not sure it wasn't
10 there before, but it was not quite so visible and they are
11 looking at their appropriate role as again is the Commission
12 staff.

13 CHAIRMAN SELIN: Fair enough. Okay. Let me just
14 react to your statement and then my colleagues will have
15 their points as well.

16 On the multipurpose canisters, I think you have,
17 at least from my point of view, addressed the issues I've
18 raised in the last year. I think it's very clear that you
19 realize that there's a question of timing of the MPCs with
20 respect to the waste concept and to the limitations of what
21 we can and can't do in talking about disposal when we don't
22 know that much detail about the disposal concept. It sounds
23 very plausible.

24 On the LSS, I've already stated how pleased I am
25 with progress to date.

1 On quality assurance, I think it's okay. I really
2 think you underestimate the internal communication problems
3 within different levels of your own office, but maybe
4 they've been fixed because a lot of things that came as a
5 surprise at your level were not a surprise at lower levels.
6 But I assume that's one of New Year's resolutions, is not to
7 have that happen. Again, it's happened to us sometimes
8 also, I must admit, but it's not two monolithic groups
9 having trouble communicating, it's tying a lot of knots
10 together at different levels where there's sometimes better
11 interfaces horizontally than there are vertically.

12 From an analysis point of view, it is a funny
13 thing for a regulator to say, but water transport is the
14 issue more than anything else. So, although you've got to
15 touch all the basis, that's where the substantive emphasis
16 has to be pushed and I assume that we won't distract you
17 from that by bringing up statutory legal procedural
18 questions on these others. You know, they all have to be
19 addressed, but that's really where the site will rise or
20 fall and we realize that. I assume you realize that and we
21 expect that to be the core of the discussions that you're
22 going to have with the staff.

23 Finally, the worrisome process about the two types
24 of application. My own thinking, I see three kinds of
25 issues that have to be addressed and, of course, there's

1 some interchange, but I think it's not a bad taxonomy to
2 look at that. The first are technical communications to
3 make sure that issues are identified, addressed early, that
4 the disposal concept gets carried forward in the MPC. All
5 these types of questions that say, "We have addressed these
6 issues. We've told you what we think they are. You tell us
7 what the issues are." We continue to talk and identify
8 these and these are major issues, regardless of the concept.
9 Sometimes it's for one waste concept, sometimes for the
10 other. They're clearly that level of communication.

11 Commissioner Rogers has correctly, in my opinion,
12 correctly stressed the resource needs, the idea that we also
13 need to do planning. As your views change, you need to tell
14 us earlier, even though you're not sure, not later, about
15 what you're thinking so we can adjust our own workload, our
16 own priorities and make sure you understand what you're
17 asking us to do because you're going to have to pay for it
18 and we don't want any surprises in that part as well.

19 But the third part is the that's got the longest
20 lead time and that is if we have to change Part 60 or we
21 have to change some of our regulatory documents that support
22 this, you can't expect to come in about six months before
23 the application and say, "Oh, by the way, we've noticed an
24 inconsistency between our approach and the rule." In a
25 sense, we're asking you to tell us things very early in the

1 process. But we do have to have a review. It's not exactly
2 a joint review. We're the regulators. We need to do this
3 review. But you sure can help us and therefore yourselves
4 by finding places, as we will try to do ourselves, where our
5 regulatory structure no longer appears to be completely
6 consistent with the concepts that you have in mind. You
7 certainly would do yourselves a favor when you do this
8 review in parallel if you came to us and say, "We're not
9 sure this is a problem, but we think there may be a
10 problem," so we can look at it from a statutory procedural
11 as well as a technical point of view.

12 I'm very uncomfortable with this concept of one
13 kind of an application which is your back-up, not your
14 preferred approach. It's very different from what had been
15 seen. It may turn out over time, but the differences
16 between the two approaches aren't so great as they appear
17 today because, as Commissioner Rogers points out, there are
18 plenty of uncertainties in the so-called low thermal
19 approach as well.

20 But insofar as we really are talking about two
21 different applications or two quite different concepts, that
22 raises all kinds of questions. We've had a satisfactory
23 discussion and I'm comfortable we both understand that there
24 are questions, but we don't know what they are. We may turn
25 out to have a lot of problems with this approach. We will

1 strive not to be bureaucratic and say, "I'm sorry, that's
2 not what we planned on. You can't do it." But there are
3 just all kinds of things that haven't been thought out for
4 that concept. The idea was, in retrospect, probably
5 unrealistic, but you sort of knew all the answers even
6 before you'd asked all the questions. But this is a very
7 different approach from what we have been prepared for and
8 we need to think this out ourselves with your help, with
9 other people's help quite publicly and see if we can get
10 from here to there.

11 Commissioner Rogers?

12 COMMISSIONER ROGERS: Well, I certainly support
13 the Chairman's comments.

14 I want to say that I really thought your prepared
15 statement was just excellent, first rate. I almost enjoyed
16 reading it.

17 DR. DREYFUS: God forbid.

18 COMMISSIONER ROGERS: I felt it was very clear,
19 very well articulated and really hit on most of the
20 important points. That isn't to say that there aren't
21 issues that we might be concerned about, but I just thought
22 it was really a pleasure to see such a clear document to
23 start our discussion with because it was not loaded with a
24 lot of bureaucratic jargon that one had to try to interpret.
25 It was very clear, very clearly stated and I appreciate that

1 very much.

2 Let me raise a couple of issues. One, in my
3 looking over the Technical Review Board's letter to you back
4 in December 6th, I guess, it looks as if they're pressing
5 for a great deal more exploration underground than you're
6 planning and I'd like your comments on that.

7 One of the first points they made was that they
8 felt that you should excavate a main drift through the
9 center of the repository block in an approximately north-
10 south direction parallel to and just west of the Ghost Dance
11 Fault zone. In your prepared remarks, on page 12 you said,
12 "The underground drift was deliberately placed so that it
13 would not interfere with eventual repository development.
14 It is not longer a main running down the center of the
15 block." Are those talking about the same thing or is this -
16 - in other words, in your statement to us, is that a
17 statement that you're not going to do what the Technical
18 Review Board is suggesting here, a drift through the center
19 of the block, or are these two different issues?

20 DR. DREYFUS: Well, first of all, that letter I
21 have not addressed. We have not staffed it out internally.
22 So, we don't have specific answers. My recollection of the
23 letter is that a big part of I agree wholeheartedly with.
24 It's a cry for more explicit articulation of the strategy
25 and the program and locking them together and we're working

1 on that. So, I'm in accord with it.

2 The Board does ask for, I think, fairly extensive
3 additional underground exploration.

4 COMMISSIONER ROGERS: Yes.

5 DR. DREYFUS: A portion of it is at Calico Hills
6 which we have viewed as being something we would decide
7 about as we understood better what the need for that
8 formation would be and also what we find out in the higher
9 formations. That particular drift I am not well enough --

10 MR. BROCOUM: I can answer.

11 DR. DREYFUS: Yes, why don't you.

12 MR. BROCOUM: That north-south drift west of the
13 Ghost Dance Fault is the main drift that we're going to be
14 constructing with the ESF there. What they're agreeing in
15 that particular drift is we're going to go down the ramp and
16 turn south. We'll be west of the Ghost Dance Fault. So,
17 that particular drift you refer to is one that we are
18 constructing.

19 COMMISSIONER ROGERS: Okay. All right. So, the
20 statement just didn't seem to indicate that. But I'll take
21 your --

22 MR. BROCOUM: I think the comment we would have -
23 - I don't remember exactly what the letter said, but if they
24 were suggesting an east-west drift through the center of the
25 repository block, we may have some problems with that

1 because --

2 COMMISSIONER ROGERS: No, no, no, north-south.

3 MR. BROCOUM: But the north-south one is the one
4 we're building.

5 MR. BARRETT: In summary, that plans that we are
6 doing are consistent with the Board's recommendation. We
7 are going north-south. It's just shifted and we've changed
8 the repository design with that in the conceptual design
9 report that we submitted.

10 COMMISSIONER ROGERS: Okay. Fine. I just
11 wondered whether you were in sync with them.

12 MR. BARRETT: We are.

13 COMMISSIONER ROGERS: That's really the big
14 question.

15 Do you feel that the kinds of things that the
16 Technical Review Board is asking you to do and the approach
17 that our staff is pressing you on are at odds with each
18 other in any way? Are we tugging you in different
19 directions here?

20 DR. DREYFUS: I can't think of any particular
21 place where that is a direct conflict. The Board tends to
22 be operating in a slightly different arena, more towards the
23 question of how much work needs to be done in a specific
24 scientific sense in order to have an answer. The staff is
25 more interested in how we address the regulatory

1 requirements, so there's a slightly different kick.

2 Now, some of these tend to come down to the same
3 question of how many holes have you drilled and how much
4 pneumatic information have you got before you do something,
5 but by and large they have very different viewpoints.
6 They're not, as far as I know, inconsistent. By and large,
7 the Board is pushing us in the direction that we are
8 desperately trying to go.

9 We understand the need to articulate the strategy
10 better and I think if we do that -- and of course because
11 it's changed, you see, we are in fact doing rethinking based
12 on what we now know. And if we do that, I think it will
13 also go a long way towards resolving the staff's difficulty
14 in following the action. As I say, all of this
15 documentation is within about three or four months old and
16 before that it was pretty sketchy, but it was also
17 formative. You can't document it until you do it.

18 So I think they're both moving in the same
19 direction. They want better more closely knit statements of
20 what the concept is and how it relates to today's work and
21 so do I and we will be doing that as we go forward.

22 COMMISSIONER ROGERS: On this issue of bounding
23 analyses, we've been trying to understand how you are going
24 to use those and without trying to press you for more
25 details on that are you supporting any work, any studies on

1 exactly how a collection of bounding analyses could best be
2 used in your application?

3 DR. DREYFUS: Well, at the highest level of
4 abstraction it's a question of we will always use bounding
5 analyses because we will never have definitive notions of
6 what's going to happen in this repository over 10,000 years.
7 The question is, to what extent can we narrow the bounding
8 analyses with additional data analysis in order to avoid
9 having what essentially turn out to be very great safety
10 factors or perhaps having disqualified a site that could
11 have been viable. That's the essence of it.

12 Do you want to make a few --

13 MR. BROCOUM: Well, I can say a few things.

14 In performance assessments there are many cases
15 where they make assumptions that could be considered very
16 conservative. For example, in a waste package, the very
17 first that corrodes through, that assumption is the whole
18 waste package has failed and that water is in contact with
19 all the waste, the cladding has failed, the inner barrier
20 has failed. There are numerous cases like that.

21 Another assumption, for example, is as soon as the
22 area around the waste package goes down below boiling that
23 whole waste package has a film of water and allows corrosion
24 to go along even though capillary pressures we believe will
25 tend to keep the water in the pores of the rock. There are

1 numerous examples like that that when you add them all up
2 suggest we're taking a very conservative approach with
3 regard to the waste package, engineered barriers, and the
4 near field of the repository.

5 Some other examples on the far field are in the
6 scenarios where you can disrupt the repository in the area,
7 say, of vulcanism or climate change. We've done a lot of
8 analyses to see what the consequences of those, vulcanism
9 happening or climate change, but we've tended to be
10 conservative in how probable those occurrences are and we
11 need to look at that further to see if we can be more
12 "realistic."

13 But Dr. Dreyfus is right. Any model is
14 essentially a bound of a variation of a parameter or a
15 feature and the more information you have the narrower and
16 the more you understand it the narrower those bounds can be,
17 so it's an example of how much information you have and how
18 wide your bounds are.

19 DR. DREYFUS: Yes. The essence of performance
20 assessment, of course, is to figure out whether the
21 particular bounding condition is important or not. If it's
22 not, then there's no need to get more specific and we have
23 one such dialogue going on in another area which is the
24 fresh fuel assumption for criticality control, which is a
25 bounding condition we would like to narrow with data. It's

1 the same game in all of these others and when you start
2 stacking them up you can disqualify the site without needing
3 to. On the other hand, narrowing them in some cases would
4 require very long time frames to measure things, that sort
5 of thing, so we have to -- we just have to keep doing that
6 balancing act until we come to some optimum situation.

7 COMMISSIONER ROGERS: Well, it's just that there
8 are ways of dealing with a collection of bounded parameters
9 in analyzing the overall behavior of a system and there are
10 more and more sophisticated techniques that are being
11 brought to bear on this kind of problem. I hate to use the
12 term because it always gives problems, but the fuzzy logic
13 control systems, for example, have this kind of feature that
14 you're dealing with a range of possibilities and you're
15 trying to find a reasonable final result that accommodates
16 to all of those different ranges, and I'm just curious as to
17 whether you're looking at this problem from that abstract
18 point of view and whether you have any work going on to help
19 guide how to use this kind of data, collection of bounded
20 parameters in arriving at a result which is not simply
21 governed by taking the worst case of every upper bound of
22 everything and the lower bound of everything and winding up
23 with two widely disparate situations but actually finding a
24 solution which accommodates in some way those bounds but
25 recognizes that those by themselves are the limits of a

1 situation and are less likely to be in fact what is exactly
2 the parameter's value that you'll have to deal with.

3 DR. DREYFUS: Well, other than the performance
4 assessment which is a fairly complex piece of business and
5 probability approaches, I don't know. Are we doing
6 something specific on a theoretical--

7 MR. BROCOUM: I'm not aware that we're doing
8 anything in this fuzzy logic, but I'll have to write it down
9 to ask our people.

10 COMMISSIONER ROGERS: Well, thank you very much.
11 I found the presentation very useful and it looks as if you
12 really have got your arms around this thing to a much
13 greater degree than we've ever seen before and I
14 congratulate you for that.

15 DR. DREYFUS: Thank you.

16 CHAIRMAN SELIN: Commissioner de Planque?

17 COMMISSIONER de PLANQUE: Well, the discussion so
18 far has answered a lot of my questions, but there's one area
19 that we haven't touched on yet that I'd like to talk about a
20 little bit.

21 I've seen some good regulatory concepts go by the
22 wayside because of maybe inadequate preparation in terms of
23 public understanding and this clearly will be a very public
24 process, at least from our end, and this brings me to the
25 subject of expert judgment. I'd like to know a little bit

1 more about what you're doing in this area, how well you are
2 coordinating or if you're coordinating with our staff, with
3 the Academy or any of the advisory groups.

4 I know the Technical Review Board did bring that
5 up as one of the things that needs to be addressed. I think
6 they put it a little lower in priority in terms of timing,
7 but I myself wonder about that, how much work have you done
8 in terms of defining it, how you elicit expert judgment, how
9 you use expert judgment, and how the public process might be
10 enlightened as to how this is going to be done.

11 DR. DREYFUS: You are the expert.

12 COMMISSIONER de PLANQUE: Here comes the expert
13 judgment.

14 DR. DREYFUS: He's the principal consumer of
15 expert judgment.

16 MR. BROCOUM: This is a question as far as the TRB
17 has asked us several times over the last several years. We
18 have a history of doing expert elicitation. We had the
19 Calico Hills risk benefit study. We had the ESF alternative
20 study. We've had the integrated test evaluation study where
21 we would bring an expert in decision analysis and elicit the
22 program participants in technical areas.

23 ESF alternatives was a very complex study, had
24 maybe ten or 20 different panels with perhaps 100 experts
25 involved.

1 We also had a meeting, I think it was in Tucson
2 several years ago. I don't remember if it was in Tucson on
3 expert judgment. And we also participated on an
4 international expert judgment in Paris about a year and a
5 half ago or two years ago.

6 What we have not done to date, though, is come up
7 with an optimum policy on the use of expert judgment and
8 that is the question that a lot of -- you just, in a sense,
9 asked us, the TRB has asked us. So though we have a lot of
10 experience, we haven't come up with an encompassing policy,
11 but we are tasked and we are coming up with a draft policy
12 to use in public forums with the TRB and others to come up
13 with an optimum policy, but as of this moment we don't have
14 an overall optimum policy that encompasses that.

15 COMMISSIONER de PLANQUE: Are you working directly
16 with our staff on ideas for this?

17 MR. BROCOUM: I'm not sure we have worked recently
18 with the staff. I don't recall a meeting recently on expert
19 judgment. I'm looking at some of your staff here. No. No,
20 I don't think we've had a recent meeting with your staff on
21 expert judgment, but as soon as we have a draft policy
22 written we will have a meeting with your staff and with the
23 TRB to discuss this. This is an area of intense interest by
24 a lot of parties, so we have taken that action.

25 COMMISSIONER de PLANQUE: Do you have any target

1 dates for this?

2 MR. BROCOUM: I'm a little hesitant to give you a
3 target date. I would say it would be the first half of this
4 year we'd have a draft policy.

5 COMMISSIONER de PLANQUE: Okay. All right. It
6 just seems to me it's an issue that's easy to ignore, not so
7 much in terms of how the agencies use the expert judgment
8 but in terms of how you present it as a credible process in
9 the public arena. That could be difficult.

10 MR. BROCOUM: One of the issues is all these
11 examples I have given you the experts have all been program
12 participants, and some of the questions people ask, "Can we
13 have some of our own experts participate, you know, be
14 involved in the panels," and that's one of the policy issues
15 that needs to be discussed and debated.

16 COMMISSIONER de PLANQUE: Okay.

17 Well, I'd like to echo my colleagues in saying I
18 thought your planned remarks were very useful and we
19 appreciate your coming here today.

20 CHAIRMAN SELIN: I have one wrap-up remark and it
21 has to do with the definition of the waste disposal concept.

22 We understand a little bit more about how you're
23 going about this. I assume there's a very clear document
24 back there some place that we'll get to look at, but I know
25 you don't get this overnight and I know there's a lot of

1 feedback between what you find on the scientific side and
2 how you modify your concept.

3 But I do want to stress -- I'm satisfied with your
4 answers so far, but it's just -- that just buys some time.
5 I do want to stress the importance of having relatively
6 concrete concepts also described in one place and not
7 throughout. The fact that we didn't stress this today is
8 because you've given us a plausible answer about what you're
9 doing and how much time it takes, but that is paramount in
10 the ability to deal with this as well as, I believe,
11 Commissioner de Planque's point about being able to explain
12 to the public what you're doing.

13 Thank you again for coming over and it was a very
14 successful meeting from our point of view.

15 DR. DREYFUS: Thank you very much.

16 [Whereupon, at 11:12 p.m., the above-entitled
17 matter was adjourned.]

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CERTIFICATE

This is to certify that the attached description of a meeting of the U.S. Nuclear Regulatory Commission entitled:

TITLE OF MEETING: DOE BRIEFING ON STATUS OF HIGH LEVEL
WASTE PROGRAM - PUBLIC MEETING

PLACE OF MEETING: Rockville, Maryland

DATE OF MEETING: Monday, December 19, 1994

was held as herein appears, is a true and accurate record of the meeting, and that this is the original transcript thereof taken stenographically by me, thereafter reduced to typewriting by me or under the direction of the court reporting company

Transcriber: Carol Lynch

Reporter: Peter Lynch

**STATEMENT FOR THE RECORD
PRESENTATION TO THE U.S. NUCLEAR REGULATORY COMMISSION
STATUS OF THE CIVILIAN RADIOACTIVE WASTE
MANAGEMENT PROGRAM
BY
DANIEL A. DREYFUS, DIRECTOR
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY
DECEMBER 19, 1994**

Introduction

Chairman Selin and Members of the Commission:

I am pleased to be here once again to brief you on the status of the Civilian Radioactive Waste Management Program. In my first briefing to you last December, I reported on our evaluation of the need for improving our program. In my briefing last June, I outlined what we then referred to as the Proposed Program Approach and our plans to address the waste acceptance, storage, and transportation issues; and I discussed our reorganization. I stated the obvious - that to achieve our objectives we had to have the support of the Administration and the Congress for a funding profile that would support a more effective program approach. In addition, I informed you of our need for the Commission's comments on our restructured program and the support of your staff in reviewing the many documents we would be submitting.

We achieved a great deal in 1994 despite the continuing constrained funding that was available to us. I will review our achievements - in redirecting our program, evaluating the suitability of the Yucca Mountain site, and addressing the waste acceptance, storage, and transportation issues that are before us. In addition, I will outline our plans for 1995.

Our efforts in 1994 did, however, give rise to specific issues that require our attention. The events of the past few months - the views of your staff on our high-level waste program, their comments about our quality assurance program for the design control process, our interactions with your staff in connection with our topical reports on Extreme Erosion and on the assessment of Seismic Hazards, and their views on the important issue of criticality control and burnup credit - are evidence of this. They were the direct result of our interactions with your staff and the guidance and comments it has provided in response to our request. Your staff, in expressing its opinions, provided the input we requested and has contributed to our progress.

My own evaluation of these events is that they indicate that we will have to communicate much better. We weren't hearing what you were telling us and you weren't

hearing what we thought we were telling you. The need for better communications has increased, in part, because we have been involved in substantially restructuring our program approach and management organization. Detailed descriptions of our new approach could not be made available to you until recently because we were defining the detail as we engaged you in dialogue. In some aspects of our program that is still the case, but the documents listed in Table 1 attached to this statement are indicative of the voluminous information that we now have provided to describe the plans and the concepts we are developing.

In my remarks today, I will therefore address the issues outlined in your letter of November 23, 1994, several of the concerns your staff expressed about our high-level waste program on October 31, 1994, and I will try to put them into perspective. I will address some of these matters in the Progress in 1994 and Plans for 1995 sections of this statement; I will address others specifically.

Progress in 1994

Probably, the most important accomplishment in 1994, and the key to our progress in the future, was the determination of the level of financial support that would be supported by the Administration and the Congress. The Congress, acting on its belief that we can and will be able to achieve our objectives, agreed to the Administration's proposed 40 per cent increase in funding for FY 95 despite severe government-wide budgetary restrictions. Most of the additional funding we have received for FY 95 has been allocated to the Yucca Mountain site characterization activity. I am hopeful that the future funding profile proposed with our FY 95 budget outlined in Figure 1 attached to my statement can be attained despite the much more restrictive deficit controls across the government that can be expected in the years ahead. Other highlights of our progress follow.

• Repository Investigation

During the past year, we developed a new approach to the site suitability determination and the licensing of the proposed Yucca Mountain repository. We reevaluated our approach to achieving the objectives mandated under the Nuclear Waste Policy Act, as amended, to ensure that:

- efficient, measurable progress toward determining the suitability of the Yucca Mountain site for a permanent repository is made and, if the site is suitable, that the program is able to proceed with the environmental impact statement, site recommendation, and licensing and construction of a repository; and
- the technical approach and schedule are as aggressive as we can hope to achieve, and consistent with established funding levels and with expectations of stakeholders, including the Congress.

The new program approach is an attempt to bring the program back to the original intent of the legislative and regulatory framework. The approach provides a management tool to focus site characterization and engineering activities initially on that information deemed necessary and sufficient to support a technical site suitability determination. I shall discuss the intent of this determination later in my presentation.

Related major accomplishments in 1994 were the completion of the predecisional draft of the "Yucca Mountain Site Characterization Project Five-Year Plan Fiscal Years 1996-2000" and our recent submittal of "The Yucca Mountain Technical Implementation Plan for Fiscal 95." These plans flesh out the restructured program I outlined last June that we are now implementing. We have sought public comments on the process for evaluating site suitability that we noticed in the Federal Register in August. Your staff presented its views on these plans in its meeting with you on October 31 and in a videoconference with my staff on December 2. I will also address them later in my presentation.

During 1994, the Yucca Mountain project made progress in surface-based testing, advanced conceptual design, performance assessment, planning, licensing support system development activities, and progress in constructing the Exploratory Studies Facility (ESF).

The surface-based testing activities included ongoing geological investigations that have provided information being used in the design of the ESF, scientific studies of the saturated and unsaturated zones, and tests relevant to the evaluation of the waste package environment.

We provided rock characteristics data and the results of laboratory geotechnical analyses to ESF designers. We completed construction of the discharge piping and spreading basin for the C-Well complex in preparation for the saturated zone pumping studies we will conduct in FY 1995. We successfully completed tests of the grouting technique we will use to instrument the boreholes in which we will make pneumatic measurements this winter. We also conducted air-permeability tests in UZ-16, NRG-7a, and NRG-6, gas phase geochemical sampling in UZ-16, and gas sampling, temperature, air pressure, and humidity tests in UZ-1. We continued our geophysical, Quaternary faulting, geochemistry, and climatology investigations. In the process, we've obtained a better understanding of chemical retardation. We also validated our regional climate modeling code. That work demonstrates that there is reasonable agreement between model results and the observed present-day climate.

We continued our waste package and repository advanced conceptual design effort. The waste package effort includes the concept evaluation, mechanical and thermal design work, and materials testing and evaluations, all of which we discussed with your staff on December 7. Our goal is to develop a waste package with a mean lifetime well in excess of 1,000 years. This waste package will be a robust, multi-barrier package that is compatible with the multi-purpose canister. We are considering designs and materials that will be appropriate for use in the repository thermal loading scenarios we are evaluating. Just recently, we provided

to your staff our "Initial Summary Report for Repository/Waste Package Advanced Conceptual Design." This report includes a description of our current geologic repository operations area concept, a matter of considerable interest to your staff . It also includes the technical requirements for the engineering compatibility of the multi-purpose canister with the waste package. The concept of the interface between the ESF and the repository was illustrated in the six interface drawings appended to our Exploratory Studies Facility Design Requirements document previously provided to your staff.

Performance assessment work continued. The purpose of this work is to support evaluation of compliance with regulations, evaluate alternative repository and waste package designs, and provide guidance for our site characterization work. In September, we met with your staff to discuss our most recent results. In addition, in support of tunnel boring machine activities, we are placing added emphasis on using performance assessment to evaluate the potential impacts on waste isolation of designs and materials that might be used in construction.

We recognize that the Licensing Support System (LSS) is indispensable to the Commission's acceptance and review of the DOE license application and we remain committed to developing the LSS in a timely and cost-effective manner. To support this commitment, the Project chartered a working group earlier this year to examine the current LSS development strategy. The group was tasked with identifying enhancements to the strategy to ensure that LSS development fits within the framework of the Program Approach. The working group completed their work in October and delivered a draft report summarizing their findings to us for our review. This report includes LSS implementation alternatives as well as detailed cost and schedule projections for each alternative. This document is currently under internal review. Once it has been finalized, the report will be made available to the staff and interested stakeholders.

My staff has attempted to keep the LSS Administrator and LSS Advisory Review Panel informed on the working group's effort since it is recognized that their input and advice is essential to acceptance of the LSS. We have also been working closely with your staff to identify alternatives for funding LSS operations. Discussions to date have centered on shifting fiscal responsibility to the Department while designating a NRC staff member as the Contracting Officer Technical Representative over the operations contract. Another alternative currently under consideration is a cooperative agreement with the University of Nevada, Las Vegas, to house and operate the LSS with funding obtained through direct Congressional appropriations. Regardless of the final details, the Department will continue to work closely with your staff to identify an arrangement that is acceptable to both agencies as well as the stakeholders.

The ESF is an integral part of our effort to evaluate the suitability of the Yucca Mountain site. In 1994, we completed and released for construction the ESF Title II design packages

required for excavating the North Ramp of the facility from the surface to the Topopah Spring level. This year, we received, assembled, inspected, and moved the tunnel boring machine (TBM) into the starter tunnel and commenced the testing phase of TBM operations. During this phase, tunnel excavation activities were conducted to the extent required to test, evaluate, and adjust TBM equipment and, in addition, to evaluate and improve the performance of TBM operators. We completed the testing phase and initiated TBM shakedown operations on November 7. These operations include incorporating the required improvements identified during the testing phase and excavation at a rate consistent with system capability to which the mapping platform, muck conveyor system, and permanent utility systems will be added. Operations are currently on hold. We are assembling and installing the mapping platform and plan to resume operations by January 9, 1995.

We also conducted many technical exchanges, management meetings, and site visits with your staff and the Advisory Committee on Nuclear Waste (ACNW) on a variety of subjects. These include our issue resolution activities which I also will address later in my presentation. As I indicated earlier, I believe that they have been productive.

- Waste Acceptance, Storage, and Transportation

Resolution of waste acceptance, storage, and transportation issues is of critical importance as I reported last June. To address these issues, which are becoming very visible in the political arena, we have several objectives. We are preparing to be able to participate knowledgeably in the forthcoming debate on interim storage options, we are developing a capability to meet the challenges of transporting spent fuel in a timely fashion, and we are striving to make advanced storage and transportation technologies available to the marketplace.

Last May, the Department issued a Notice of Inquiry to elicit the views of affected parties on (1) the Department's preliminary view that it does not have a statutory obligation to accept spent nuclear fuel in 1998 in the absence of an operational repository or a suitable storage facility constructed under the Nuclear Waste Policy Act of 1982, as amended; (2) the need for an interim, away-from-reactor storage facility prior to repository operations; and (3) options for offsetting, through the use of the Nuclear Waste Fund, a portion of the financial burden that may be incurred by utilities in continuing to store spent nuclear fuel at reactor sites beyond 1998. We received more than 1,000 comments, and extended the comment period to December 19, 1994. We are evaluating the comments in the context of the litigation that has been initiated by some stakeholders and as a basis for forming Administration positions on anticipated legislation dealing with the waste acceptance and interim storage issues.

In June, we issued a request for proposal (RFP) for the design of a multi-purpose canister (MPC) subsystem. This subsystem would help to standardize spent nuclear fuel storage at reactor sites, or at interim storage sites if they are developed. It would facilitate

transportation and, if we are successful, it would simplify disposal. We received and responded to vendor questions, amended the RFP, received proposals, and expect to award one or more contracts in April 1995. In a related effort, the Department published a summary report entitled "Multi-Purpose Canister System Evaluation - A Systems Engineering Approach" which provides background information and the rationale for proceeding with the MPC concept.

In support of this overall effort, the Department, on October 24, 1994, issued a notice of its intent to prepare an Environmental Impact Statement to support a decision on the fabrication and deployment of a multi-purpose canister-based system for the management of civilian spent nuclear fuel. We conducted three scoping meetings in November and December and expect to complete the statement and, later, the record of decision in 1996.

Over the past several months we have been discussing with your staff the issue of criticality control as it relates to the design and use of the multi-purpose canister subsystem in transportation, long-term storage and, eventually, disposal. The issue is important because our criticality control strategy is based on both the use of burnup credit to effectively take into account the reduced reactivity of spent nuclear fuel and currently accepted design features. We are working to provide the information your staff will need for early acceptance of our approach. I will discuss this issue in more detail later.

In support of our transportation initiatives, in July and August we submitted safety analysis reports to the Commission for the GA-4 and GA-9 legal weight truck casks. We are working with you to certify these casks in order to ensure their timely availability.

We also continued to pursue the activities required under the provisions of §180(c) of the Nuclear Waste Policy Act for training on procedures for safe, routine transportation, and for dealing with emergency response situations. With respect to our efforts to work with stakeholders in this regard, we plan, early in 1995, to publish a Notice of Policy and Procedures to establish the requirements of §180(c) and publish the Policy and Procedures themselves early in 1996. We previously committed to begin implementing these requirements 3-5 years prior to the first shipment of spent fuel and plan to publish the final rule on a schedule consistent with this commitment.

This work is essential to prevent transportation arrangements from constraining the policy options that may be considered by the Congress for early removal of spent fuel from reactor sites.

Plans for 1995

Our plans for 1995 are ambitious. We intend to make further progress in evaluating the suitability of the Yucca Mountain site, in complying with the requirements of the National

Environmental Policy Act, in resolving licensing issues, and in acquiring the information we need to support these activities. We also intend to make progress in our waste acceptance, storage, and transportation activities.

- Repository Investigations

We have finalized our site suitability evaluation process by taking into account the input we have received from stakeholders and from reviewers such as the Commission. We have issued a white paper that addresses the questions that have been raised about the intent and definition of the "Technical Site Suitability" determination. We will also prepare technical and compliance documentation to support decisions on five higher-level findings for guideline conditions related to surface processes. These documents will be those prepared to support findings on the qualifying and disqualifying conditions in 10 CFR Part 960.4-2-5, Erosion; on the qualifying condition in 10 CFR Part 960.5-2-8, Surface Characteristics; and on the qualifying and disqualifying conditions in 10 CFR Part 960.5-2-10, Hydrology.

We will begin the formal NEPA process for the repository and will initiate scoping activities for the required statutory Environmental Impact Statement. We will complete the next revision of our annotated outline for a repository license application and issue it as a Department document for the first time. Next month we will submit our responses to the staff's questions and comments from their review of our topical report on Extreme Erosion. Later this year, we will submit for your review the second in our series of three topical reports on Seismic Hazards Assessment methodology.

We will continue to obtain and analyze data from surface based tests and from the tests we are conducting in the ESF during construction. We are now involved in the shakedown phase of tunnel boring machine operations and will continue tunneling in accordance with our plans, subject to the "hold" we have placed on operation beyond the upper Paintbrush Tuff non-welded (PTn) contact until we have collected baseline pneumatic data from several pressure fronts.

This pneumatic data collection work will include air-permeability testing in UZ-4, UZ-7, and possibly SD-7. The North Ramp of the ESF has been explicitly incorporated in a three-dimensional model grid and the relatively well-characterized local gas-flow system at UZ-6/UZ-6s will provide the basis for initial assignments of gas-flow parameters throughout the unsaturated zone. The site-scale gas flow model will be calibrated over the next few months, prior to the first penetration of the PTn contact, using meteorological records and associated barometric responses from the North Ramp Geologic (NRG) boreholes NRG-6 and NRG-7a. These boreholes were instrumented in November. Initial results indicate the down-hole instrumentation is working at a high level of accuracy in detecting barometric pressure changes in the unsaturated zone.

We expect to continue surface-based testing at about the same level as in FY 94. We will emphasize testing and monitoring in existing drillholes and focus on long-lead critical-path activities. As part of our approach, we will be re-examining every investigation in our technical program to ensure that it is contributing to the needs of our suitability and licensing activities.

One of our major priorities will be to assemble and analyze existing data so that we can use the data to support our efforts to demonstrate measurable progress towards a decision about site suitability.

- Waste Acceptance, Storage, and Transportation

Our waste acceptance and near-term storage activities will concentrate on the multi-purpose canister and on compliance with the requirements of NEPA. As I have indicated, we completed scoping meetings and are now preparing an Environmental Impact Statement to support a decision on the fabrication and deployment of the multi-purpose canister subsystem.

We plan to complete and submit to the Commission in May a topical report that we hope will provide the basis for your acceptance of our use of "partial" burnup credit and special cask loading procedures for storage and transportation. I shall discuss this subject in more detail later.

We expect to complete our evaluations of vendor proposals, award one or more contracts for the design of the multi-purpose canister subsystem in April, and initiate the design.

Finally, as I indicated last June, we have been working to clarify organizational roles, make participants more responsible and accountable for their work, and achieve major benefits by consolidating our major participants under the technical direction of the Management and Operating (M&O) Contractor. We recently consolidated Science Applications International Corporation (SAIC) within the M&O team, and we will be pursuing further integration and rationalization of contractor arrangements. By the end of this year, we will have fully integrated our Headquarters and Yucca Mountain offices, both across organizational lines and across the country.

Specific Issues

This past year has been a year of increasingly intensive and more frequent interactions with your staff. To some extent, this has been a natural consequence of their need to understand and respond to our initiatives. These experiences also are the kind that are likely to occur in the early stages of the interactions of a new applicant with the Commission. We are finally beginning to submit for your review, guidance, and comments, annotated outlines of topical reports, license application annotated outline updates, and topical reports describing

the results of the substantive work we have done. In the past year, we met with your staff and the Advisory Committee on Nuclear Waste many times to discuss our work. On some occasions, we've agreed. On others, we haven't. We, the DOE, are not yet fully experienced as an institution in the licensing process and neither we nor the Commission staff has any explicit experience with a venture such as the repository. That we might differ on the initial approach is inevitable. We have been learning from these increased interactions about what is needed and how to communicate better. We hope your staff has also benefitted from these exchanges. As I stated earlier, there are several particular issues that will require more of our attention in the near-term. A number of them were mentioned in your letter of November 23, 1994. They include our site suitability approach, defense-in-depth, on-going interactions with the NRC staff, quality assurance, and criticality control.

- Site Suitability Approach

I am aware of the uneasiness expressed by your staff and members of the Commission concerning the new Program Approach we have adopted to characterize the Yucca Mountain site. I also know that you have expressed your desire for greater specificity as part of this report. Obviously, detailed exposition of our approach must be provided in documents, such as our Office of Civilian Radioactive Waste Management Program Plan, and in interactions with your staff.

By way of introduction, I must reiterate that I do not believe the previous program approach was supportable any longer. It had no apparent possibility of being funded at the necessary level, it had no targets for early convergence of the multi-faceted scientific activities, and it had inadequate means for measuring annual cost and progress against meaningful paths toward convergence. The issue was not if a new approach is needed, but whether one can be found that will accomplish the objectives of the Nuclear Waste Policy Act within practical resource limitations and schedules. We believe that the new approach has the prospect for achieving these objectives. Nothing that has happened in the past year has led me to believe that we have underestimated our prospects for funding or that a more leisurely schedule would be welcomed by society. We must now establish confidence that our new approach can meet regulatory requirements. In this regard, the Department knows its regulatory responsibilities under the Nuclear Waste Policy Act, as amended. We take these responsibilities very seriously.

I will address some matters I believe need clarification such as the intent of our Technical Site Suitability determination, how we plan to sequence the making of higher-level findings, our treatment of favorable and potentially adverse conditions, our use of bounding analyses, the extent of our testing program, and our intent in constructing the ESF.

- Intent of Technical Site Suitability Determination

As I stated earlier, the Department's new Program Approach provides a management tool to initially focus site characterization and engineering activities on that information deemed necessary and sufficient to support a Technical Site Suitability determination about Yucca Mountain in 1998. The Technical Site Suitability milestone will be a determination made by the Director. It is not a Secretarial action, and it is not a final agency action. We expect to have sufficient data to make the determination late in 1998.

The Technical Site Suitability determination requires positive higher-level findings on all postclosure 10 CFR Part 960 guidelines and on all preclosure guidelines covering radiological safety and technical feasibility. It does not include findings on the NEPA-related guidelines. These will be assessed during the comment period on the Draft Environmental Impact Statement.

This step-wise approach facilitates strategic planning at lower functional levels. Making individual higher-level findings, and a formal determination of technical site suitability, provides a logical means to reach convergence on the scientific program, to establish priorities and allocate appropriate resources, and demonstrate accountability and progress to external stakeholders. It will also enable the Director to respond more substantively to questions about his evaluation of the probable adequacy of the site from a technical point of view.

- Sequencing of Higher-Level Findings

With respect to making higher-level findings sequentially, we carefully considered the possibility that in so doing we might miss interactions among findings. We therefore separated and carefully sequenced the preparation of the documents that will provide the technical basis for findings from the preparation of regulatory assessments. Such separation provides the opportunity for using more than one technical basis report in developing a finding when this is appropriate. The technical basis reports that are to be completed in 1995 and 1996 will be used to support regulatory assessments on preclosure and postclosure guidelines. Regulatory assessments for the qualifying conditions of the postclosure guidelines may not be developed until after we complete the assessment for postclosure total system performance in 1998. That assessment will capture interactions. It is logical, however, and our siting guidelines anticipate, that conclusions about each of the qualifying and disqualifying conditions will be made when the required data is available. These findings will help us define the work we have to do, measure progress, and allocate resources. We cannot simply pursue all avenues of investigation equally aggressively until we are prepared to address all of the criteria at once.

- Treatment of Favorable/Potentially Adverse Conditions

In our letter of October 28, 1994, we advised your staff that the Department was reconsidering its position about the use of favorable and potentially-adverse conditions in making higher-level findings. We made our decision available in public meetings held earlier this month. That decision is that in evaluating the qualifying and disqualifying conditions for each guideline in 10 CFR Part 960 we will take into account the information we have that is relevant to the favorable and potentially adverse conditions. We will also consider other relevant site-specific information in our evaluations. We will not, however, make formal findings on the favorable and potentially adverse conditions.

- Use of Bounding Analyses

We are sensitive to the Commission's and the staff's concern that reliance on bounding analyses might lead to excessive conservatism. We feel that in a number of areas, our performance assessments conducted to date do exhibit the impacts of conservatism, especially impacts relating to the performance of the corrosion-resistant barrier of the waste package, cladding performance, and the expected dissolution rate of the waste form. Future performance assessments are planned to evaluate the significance of these and other conservative assumptions. We intend to reduce the degree of conservatism incorporated into our analyses to the extent that we can based on the results of site and materials testing investigations. However, we also believe that evaluating the consequences of conservative assumptions will continue to be an important component of our performance assessments and will be the focus of future interchanges with your staff. The ultimate balance between conservative bounding analyses and the reduction in uncertainty that can be obtained in some cases with more time and cost will be refined as we gain better understanding of system performance.

- The Extent of DOE's Testing Program

Last June, I advised that we would, over time and consistent with your regulations, be providing increasingly more detailed information as we progressed from site evaluation, through the licensing process, to an updated application for a license amendment authorizing permanent closure. Contrary to the impression that might have been drawn from the transcript of the staff's October 31 briefing, our investigations won't stop in 1998 when we expect to make our Technical Site Suitability determination. We will continue or conduct additional tests and perform additional analyses first to provide a basis for our EIS and then for our license application. If we are authorized to construct a repository, our investigations, including early performance confirmation investigations, will continue in accordance with the terms and conditions of that authorization to provide a basis for an updated application for a license to receive and possess. If that application is granted, we will then continue to

implement our performance confirmation program in accordance with Commission regulations. Our investigations will continue long after that, perhaps for as much as 100 years.

- DOE's Intent In Constructing The ESF

I also can assure you that, in constructing the ESF, we are not constructing a repository in advance of a license. We will only be constructing the underground access we need to conduct the investigations required for evaluating the site and for designing a repository. Everyone - the Department, scientists at the U.S. Geological Survey and the national laboratories, the National Academy of Sciences, the Nuclear Waste Technical Review Board, and your own Advisory Committee on Nuclear Waste - agreed that to characterize the site we had to get underground. The Board was explicit in recommending that we use tunnel boring machines and get underground as quickly as possible. In revising our program approach, moreover, we have reduced the planned ESF to the minimum tunneling that we expect will provide the information needed for decisions. Indeed, we have had expressions of concern from the Nuclear Waste Technical Review Board that we reduced the ESF too much. The five or so miles of exploratory tunneling and ramps may be integrated into the repository, if it is built, but equating it to the more than 100 miles of drifts that would be needed for the repository puzzles me. The underground drift was deliberately placed so that it would not interfere with eventual repository development - it is no longer a main running down the center of the block. We will not surprise you or anyone else with a completed repository.

• Defense-In-Depth

Defense-in-depth is another matter I will address by discussing our commitment to it, the technical basis for our waste isolation strategy, our waste disposal concept and repository thermal loading, performance allocation, the coupling of our repository strategy and the MPC, and our plans for taking into account physical and temporal stability and gas phase release and transport.

- DOE Commitment to Defense-In-Depth

The DOE Program Approach will not place reduced emphasis on the Commission's defense-in-depth philosophy. It was developed to address all of the Commission's subsystem performance objectives as well as the total system performance objective in a sequence designed to build confidence in the system in a stepwise manner. We now intend to develop a robust, multi-barrier waste package, but we are also committed to complying with the Department's siting guidelines and the Commission's regulations, both of which require explicit consideration of the capabilities of the natural system contributing to waste isolation. Such compliance will ensure that our approach will be consistent with the Commission's philosophy.

- Technical Basis for Waste Isolation Strategy

Our current waste isolation strategy remains fundamentally the same as that embodied in the Department's 1988 Site Characterization Plan (SCP). The strategy as identified in the Five Year Plan continues to identify low liquid saturation in the vicinity of waste packages as a key element in controlling waste package corrosion as well as limiting waste form dissolution and radionuclide transport in the engineered barrier system. In addition, the strategy identifies the need to design long-lived waste packages to limit the release of gaseous radionuclides. Finally, the strategy acknowledges the potential role that the saturated zone will play if a long-term individual dose-based environmental standard is promulgated.

Our current strategy and that embodied in the SCP both utilize a defense-in-depth approach. Both rely on a natural barrier with low liquid saturations and low aqueous flux. Both rely on engineered barriers which limit the releases of radionuclides. They differ in some specifics which relate to in-drift vs. borehole emplacement and thick-walled multi-barrier vs. thin-walled waste package materials. These differences are the direct result of the multi-purpose canister development and more advanced understanding of the probable near-field environment for the waste package.

This strategy leads to our focus on hydrologic flux and the hydrologic flow mechanisms in the unsaturated zone. It requires that we develop a good understanding of the environmental conditions likely to exist around the waste packages and provide a satisfactory basis for bounding arguments about radionuclide migration. Based on it we intend to obtain over the next five years the site data required to support repository design and preparation of the license application, and provide the basis for our performance confirmation program. We will conduct long-duration *in situ* tests to investigate coupled processes. We plan to conduct these long-term tests, which should permit us to resolve the thermal loading design issues, between 1997 and 2008 and will use their results in updating our license application.

- Waste Disposal Concept/Repository Thermal Loading

The waste disposal concept we are developing calls for in-drift emplacement of large, robust, multi-barrier waste packages in a repository. The concept is illustrated in our "Initial Summary Report for Repository/Waste Package Advanced Conceptual Design." That design has not progressed to the point where we can decide on a design thermal load. We must, therefore, keep our options open until we have obtained the information we need to support a decision.

We plan to develop a design for the repository and waste package, including the multi-purpose canister, that is flexible. Consistent with this strategy, our technical site suitability determination in 1998 is likely to be based on a low range reference thermal loading design and evaluation of the sensitivity of our determination to the range of thermal loadings under

consideration. In the Environmental Impact Statement scheduled for the year 2000 we will estimate the effects of higher thermal loads. The license application we plan to submit in 2001 will be based on a design consistent with a low range thermal loading and the information that will be available at that time to support such a design. In support of that application we will provide among other things evaluations of the effects of higher loads on the engineered barrier system and repository performance. If the results of the long term *in situ* heater tests we conduct during construction are favorable will we attempt to move toward higher thermal loads in the updated application we plan to submit in 2008 for a license to receive and possess. We will, of course, conduct confirmatory tests as we operate the repository in accordance with the provisions of our performance confirmation program. The alternative would be to delay the EIS, the design and the initial license application until multi-year in-situ thermal loading studies can be completed and the choice between lower and higher thermal loads is resolved. That approach would add a decade to the target date for the application.

We believe that our planned approach will permit us to complete our site suitability determination and the Environmental Impact Statement, and provide in license applications the information the Commission requires.

- Performance Allocation

We have maintained our strategy of performance allocation among the different barriers. We still believe that the natural and engineered barriers work in concert to limit the contact of water with the waste packages and the waste form, which in turn limits the degradation rate of the containers and release from the engineered barriers. The strategy is still fundamentally based on a defense-in-depth philosophy, which serves to mitigate against uncertainties in the performance of both engineered and natural barriers. Although we have not formally used the performance allocation process put forward in the SCP and have not revised the performance allocation tables, we have used the results of performance assessment and design analyses to identify the major uncertainties, which have then been used to prioritize the site characterization activities.

- Coupling of Repository Strategy and The Multi-Purpose Canister

Our strategy for the repository is closely coupled to the work we are doing to develop the multi-purpose canister. Personnel involved in developing the waste package are working closely with those involved in developing the multi-purpose canister. The multi-purpose canister design specifications we released to industry incorporate provisions for satisfying the requirements of 10 CFR Parts 71 and 72 and for compatibility with the requirements of 10 CFR Part 60 to the extent that we are able to apply them at this time. Consistent with the Part 60 requirements the specifications require, among other things, consideration of long-term control of criticality, thermal design requirements, and materials of construction. We

will compare the design of the multi-purpose canister and the maturing repository and waste package designs regularly. We plan to complete the waste package Title I design in 1997, prior to the decision on fabrication and deployment of the multi-purpose canister, which should confirm the compatibility of the concepts.

- Physical/Temporal Stability

Regarding physical and temporal stability, our strategy continues to identify the need to evaluate the consequences associated with a wide range of potential natural and repository-induced perturbations on overall system performance. The total system performance assessments conducted to date, which have been presented to your staff, have focused on the potential effects of climate change and volcanism, as well as the impact of thermal perturbations caused by a range of thermal loads. Additional performance assessments are planned to evaluate the consequences of these and other perturbations that might impact long-term containment and isolation of waste. In FY 1995, we will be conducting geological and geophysical studies that will improve our tectonic models and help constrain our predictions of future disruptive processes and events.

- Gas Phase Release/Transport

We are taking gas phase release and transport into account. We plan to develop robust, multi-barrier waste packages with a mean lifetime well in excess of 1,000 years. These waste packages are expected to incorporate the multi-purpose canister. Our strategy does place primary emphasis on the aqueous release pathway because it is that pathway that presents the greatest potential health hazard to future inhabitants. We will, however, investigate the role pneumatic pathways would play in the performance of a repository at Yucca Mountain. As I stated earlier, in FY 95, we will obtain baseline pneumatic data from several pressure fronts, conduct air-permeability tests, and will calibrate our site-scale gas flow model. Performance assessments conducted to date have identified the significance of the cumulative release of gas-phase radionuclides, primarily Carbon-14, when compared to the release criteria of 40 CFR Part 191, even though individual doses attributable to such releases are very small. Additional performance assessments are planned to evaluate the impact of alternate robust multi-barrier waste packages on reducing the release of gaseous phase radionuclides. The Department hopes that the revised health-based standard for Yucca Mountain that is to be promulgated by the Environmental Protection Agency based on the recommendations of the National Academy of Sciences will address the gaseous release issue.

- Interactions With the NRC Staff

Our ongoing interactions with your staff in connection with our efforts to resolve issues and submit topical reports and our forthcoming interactions with the staff during the process of peer review of our technical basis reports is another matter that I want to address.

- Issue Resolution and Topical Reports

We continued to pursue our Issue Resolution Initiative vigorously in 1994 through interactions in technical exchanges and with topical reports with your staff. Our focus was on the issues of volcanism, groundwater travel time, substantially complete containment, on closing open items arising from your staff's Site Characterization Analysis (SCA) in NUREG-1347, and on erosion and seismic hazards assessment.

We have agreed with the staff that we will pursue the volcanism issue with the information we will be providing in updates to the annotated outline for preparing a license application for a potential repository. Within the past month, we completed technical exchanges with your staff on the topics of groundwater travel time, substantially complete containment and on our waste package development effort.

We have, we believe, made substantial progress toward resolving the issue of defining substantially complete containment in our discussions with your staff and in our responses to open SCA items. We noted our goal of developing a waste package with a mean lifetime well in excess of 1,000 years, our expectation that less than 1 percent of these packages will fail during the containment period, and that by executing our Waste Package Plan and Waste Package Implementation Plan we would provide the basis for demonstrating compliance with your requirements.

Our groundwater travel time effort will take several years to complete. We will work closely with your staff on this matter during that period.

In addition, we have been able to resolve at the staff level nine more site characterization analysis items. A total of 87 have been so resolved to date, 111 remain open, and of these, your staff is currently reviewing 32 of our submittals.

Our experience with the erosion and seismic hazards assessment issues warrants more attention. Despite our many interactions on these subjects, your staff advised that it could not accept the conclusions of our topical report on Extreme Erosion and it declined to accept for review our first topical report on the seismic hazards assessment issue. We did not anticipate these responses.

Our staffs, yours and mine, have been addressing this situation. On October 7, they conducted a videoconference, attended by representatives of the State and affected units of local government, to discuss the reasons for the rejections. The discussion was free and open. We learned a lot. For example, there appeared to be a consensus that erosion is really not a technical problem. We recognized that although we had previously provided the major part of the information required to support this conclusion, we had not included it in our report.

We were informed that the scope and content of our first seismic hazards assessment topical report was inconsistent with the staff's expectations of what we were going to provide. There appeared to be considerable confusion about our three-part approach to the seismic issue. In addition, we learned that in the future, any changes to topical reports resulting from internal reviews should be discussed with the staff before the reports are submitted.

Before that videoconference, my staff thought we had provided the required erosion information. We thought we had explained, and that your staff understood, our plans for preparing the three topical reports describing our approach to assessing seismic hazards at the site. We will have to communicate better in the future.

With regard to those topical reports, we were able to clarify our approach. On November 9, we provided the desired information about our three-part approach and again requested that the staff review our first seismic hazards assessment topical report. In January, we will submit detail responses to your staff's comments and questions about our Extreme Erosion topical report. The tone of our October videoconference was constructive. We need to maintain an open exchange in all of our interactions with your staff. It is an important part of the coordinating we have to do to develop an issue resolution approach that we, DOE, can accomplish and that will meet your expectations and permit you to discharge your responsibilities under the law.

During recent interactions with your staff on December 6, 1994, we learned that they want DOE to use the license application annotated outline as the principle vehicle for submission of updated information on various topics. These would include design, performance assessment, and all other topics previously considered for submission in topical reports. Topical reports will be used only for submitting information on generic topics. The staff will communicate the results of its reviews of information submitted in the license application annotated outline in the form of objections, comments, and questions. In this approach, selected individual chapters of the license application annotated outline could be revised a number of times in any given year.

- Roles of the National Academy of Sciences and The NRC Staff

We will, of course, continue our efforts to provide your staff with the information it needs to fulfill its responsibility to evaluate and comment on the extent to which our work is suitable for inclusion in a license application and to facilitate the Commission's participation in any recommendation of a site to the President. That information will include the technical basis documents, topical reports, and the license application annotated outline. We will make the documents available to your staff for review as they are developed.

We have contracted with the National Academy of Sciences to manage the process of peer review of our technical basis reports to satisfy ourselves and stakeholders that the scientific

work we have done provides a sound technical basis for our decision-making. The peer review process is explicitly intended to address the following questions:

- Have the data been collected and analyzed in a technically acceptable manner?
- Do the data, given analytical and conceptual uncertainties support the technical interpretations and technical conclusions made in the report?
- Are there credible alternative interpretations that would significantly alter the conclusions reached?
- What testing, if any, would discriminate among alternative technical interpretations?
- If such testing is recommended, how effective would it be at reducing significant technical uncertainties?

Answers to these questions will help OCRWM decide whether a technical basis report is adequate to assess compliance or whether additional testing and analyses are required. The involvement of the Academy in the review process was not intended to and should not inhibit or preclude your staff, as the Commission's representative, from making its own contribution to the review process. The Academy cannot speak to the regulatory judgments the Commission must ultimately make.

Because the technical basis reports, topical reports, and the license application annotated outlines will be developed on the schedule that was included in the staff's October 31 presentation to you, your staff will be reviewing them and providing guidance and comments to us on a regular basis. We will continue to use these annotated outlines as part of the basis for our interactions with your staff and, as suggested by the staff on December 6, we may use the annotated outline for the license application as the vehicle for informing the Commission about changes in design and providing information on single-issue topics such as erosion. The Commission's involvement, therefore, certainly will not await the year 2000 Site Recommendation Report. In addition, the staff will also be providing guidance and comments to us in the many technical exchanges and meetings we will be having in the months and years ahead.

- Quality Assurance

I now want to address your concerns about those aspects of our quality assurance (QA) program that are relevant to ESF design control. We are well aware of the Commission's basic philosophy that we have the primary responsibility for ensuring that we comply with your requirements, and that to do this we must, among other things, establish and execute a quality assurance program that meets your requirements. We accept that responsibility and are determined to live up to it.

Last year I described our plans for significantly improving our ability to execute an effective quality assurance program and for keeping your staff informed. Your staff's letter

of October 13, 1994, in which it expressed its current concerns indicated that we have much more to do. In response to that letter, on October 17, 1994, I advised the staff of our conclusions: that we had considered the important interfaces between the ESF and the GROA; that we had addressed the controls to be placed on construction activities specifically designed to prevent irreparable adverse impacts on our ability to characterize the site and on the waste isolation capability of the site; that we had addressed and corrected the deficiencies in the Design Package 2C products released for construction; and that we are continuing to address and correct the root causes of the concerns about our program. I expressed my confidence that we have in place controls that are adequate to permit us to proceed with testing, shakedown, and operation of the tunnel boring machine and I affirmed our willingness to meet with your staff to discuss these issues and continue our ongoing dialogue. We did, in fact, continue tunnel construction on October 17, although a variety of shakedown considerations have thus far limited TBM operations.

We met with your staff on November 1, 1994, to discuss its concerns in detail. On November 7, we conducted the latest of our regularly scheduled ESF technical meetings with your staff and continued the discussions during a visit to the site the next day. Finally, on November 14, 1994, we transmitted to your staff the detailed responses to its comments, questions, and recommendations and made commitments that, we trust, are responsive to your concerns and that, along with our satisfactory performance, will provide you with confidence in our ability to fulfill our responsibilities.

I believe that you should have such confidence. The Management and Operating Contractor (M&O) is realigning its Mined Geologic Disposal System Operations organization to strengthen its ability to implement the ESF, Repository, and Waste Package design functions. The M&O is also establishing a Product Integrity function to provide further assurance that all technical and quality concerns are addressed in the development of design products. The Yucca Mountain Site Characterization Office and our Office of Quality Assurance have recently formed a Quality and Design Improvement Team to perform an independent review of corrective action and non-conformance reports to determine whether there are adverse trends that require further action and to identify any areas where improvement is required.

- Criticality Control

The criticality control policy that will be imposed on canister design and certification is an important part of our development of the multi-purpose canister subsystem and the waste package. Authorization to use full burnup credit designs will permit significant cost savings throughout the waste management system. Our interest is in timely development of a system that meets your requirements for storage and transportation now, and is likely to meet your disposal requirements. Your staff has, however, suggested that we consider alternatives for

transportation that either aren't dependent on burnup credit at all or only rely on "partial" burnup credit. This suggestion is also relevant to our longer-term criticality control strategy. It could be a major consideration in the design of waste packages, repository surface operations, and, to some extent, in the thermal loading strategy.

In response to your staff's suggestions, our current approach to criticality control involves using "partial" burnup credit to effectively take into account the reduced reactivity of the spent nuclear fuel and a combination of currently accepted design features. Although the initial focus of our efforts is on storage and transportation, our multi-purpose canister work will take repository considerations into account to the extent practicable, based on information available now and that will be available during design. Similarly, initial approaches to waste package design will assume the use of the MPC. An important goal is a canister that can be loaded and sealed at a reactor site and not be opened again after storage, after transportation to a repository site, or prior to disposal. Such a canister will have substantial practical and economic advantages. The special burnup credit cask loading procedures I referred to earlier involve making measurements to verify the burnup records of the spent fuel assemblies that are to be loaded in the canister. They will provide added confidence in our use of burnup credit and the ability of our designs to control criticality that are an inherent part of the approach for which we will seek acceptance.

We plan to submit a topical report to your Storage and Transportation Systems Branch in May 1995 that, we hope, will provide the basis for your acceptance of "partial" burnup credit, including the cask loading procedures. We also plan to define later in 1995 the tests and experiments we will then have to conduct by 1998 to provide a basis for the use of full burnup credit for storage and transportation and in the repository. We will submit a revision to the first topical report after we have obtained the information we believe is required to support the use of full burnup credit for storage and transportation. Our current plans call for our submittal of a topical report on repository criticality control in FY 1998. The criticality control designs being developed for storage and transportation are compatible with those being developed for the repository. Similarly, testing activities are being coordinated so that data will address storage, transportation and disposal needs. This schedule should provide the opportunity for the required interactions with your staff. It is consistent with the planned deployment of about 160 MPCs by the end of this decade and completion of the Title I Repository Design and Title II Waste Package Design in time for our submittal of a license application in 2001.

Conclusions

I have covered a lot of ground today. I have tried to both brief you on the status of our program and address your concerns substantively. The message we have received and the

message I want to leave with you is that we have to communicate better if we are to make progress. I think that we have established the basis for doing just that.

In the coming year, we will be concerned not only with implementing our Program Approach, but also with important policy issues. These are likely to include the near-term management of spent fuel, the constraints imposed on the use of the Nuclear Waste Fund, the need for a contingency plan should the Yucca Mountain site prove to be unacceptable, and perhaps others as well.

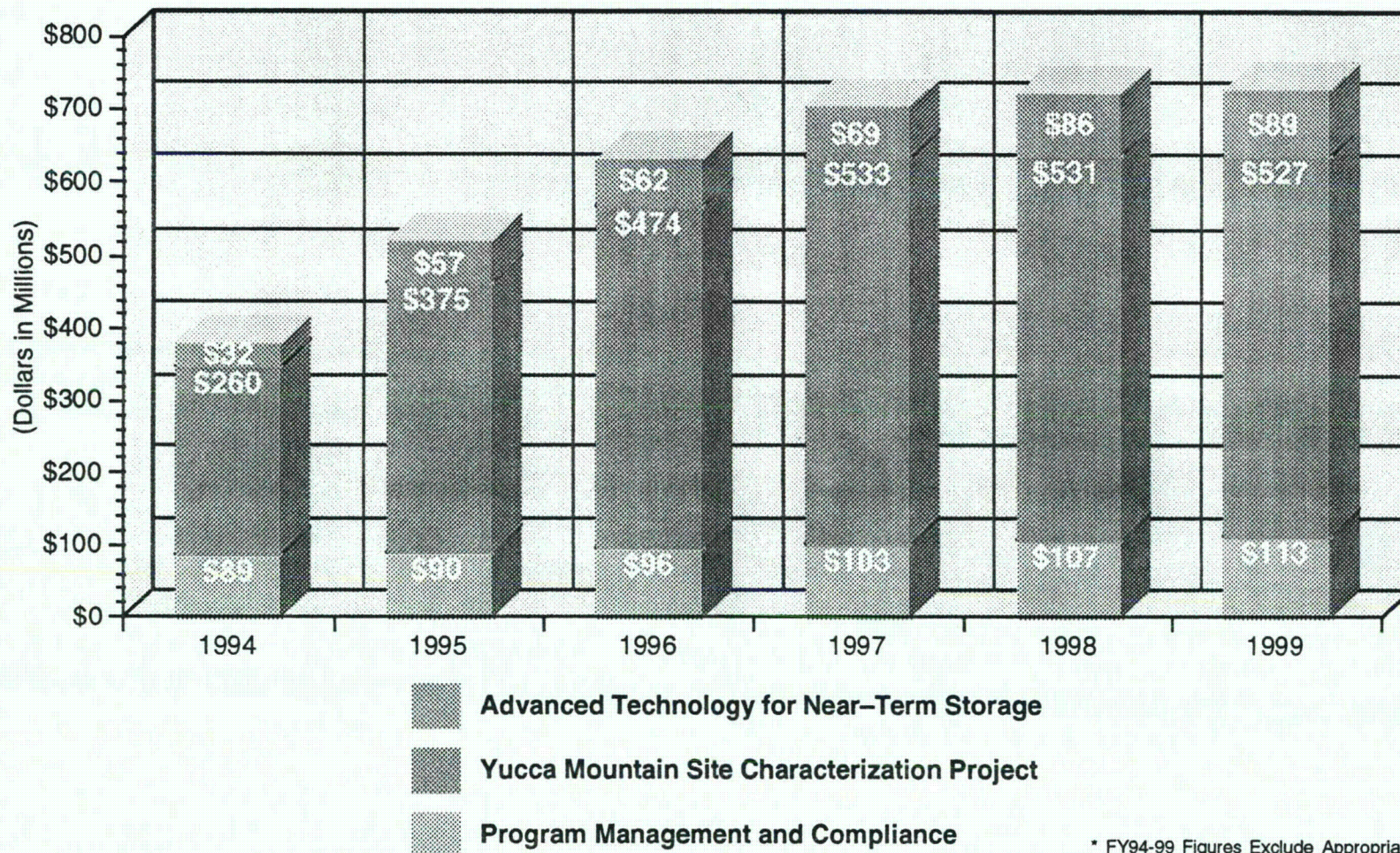
All of this will command our attention. You will be involved in all aspects of our efforts, not only in connection with our technical program and the many documents we will be submitting for review, but also in the national review of the policy issues that we must address. We look forward to your participation in the process.

Table 1
DOE Transmittals to the NRC

Date Provided or Transmitted to the NRC	Subject
12/19/94	Yucca Mountain Site Characterization Project Technical Implementation Plan (Expected to be available 12/19/94)
12/19/94	Office of Civilian Radioactive Waste Management Program Plan (Expected to be available 12/19/94)
11/94	Distribution of the Yucca Mountain Site Characterization Project Five-Year Plan (FYP) for Fiscal Years 1996-2000
11/14/94	DOE Response to NRC Concerns about CRWMS M&O QA Program
11/10/94	ESF Design Review Schedules for Fiscal Year 1995
11/7/94	Initial Summary Report for Repository/Waste Package Advanced Conceptual Design
11/09/94	DOE Response to NRC Concerns on DOE Topical Report "Methodology to Assess Fault Displacement and Vibratory Ground Motion at a Yucca Mountain," Requesting NRC Review of the Topical Report (TR#1)
10/11/94	DOE Submits Resolution to Site Characterization Analysis (SCA) Comment 101
10/07/94	DOE Submits Resolution to SCA Question 53
09/23/94	Transmittal of Study Plan 8.3.1.17.3.3
09/21/94	M&O Meeting Summary of the 3rd Bimonthly DOE-NRC Management Meeting Held September 21, 1994 in Rockville, MD
09/20/94	Compliance with SCC Requirement and Submittal of Resolution of SCA Question 47 & Comment 80
09/16/94	ESF Title II Design Review Package 2B Response to NRC Comments
09/07/94	Multi-Purpose Canister System Evaluation: A System Engineering Approach
09/02/94	M&O Meeting Summary Dated September 2, 1994, of the DOE/NRC Bi-Monthly Managers Meeting Held on July 26, 1994 in Rockville, MD
09/01/94	Transmittal of Seismic TR#1 to ACNW

Date Provided or Transmitted to the NRC	Subject
08/26/94	Transmittal of Study Plan "Batch Sorption Studies and Deviation of Sorption Models
08/25/94	Transmittal of Study Plan "Characterization of Modern Regional Precipitation
08/24/94	90% Design Review of the Integrated Data and Control System Package
08/22/94	Transmittal of AO for DOE Topical Report Seismic Design Methodology for a Geologic Repository at Yucca Mountain
08/17/94	Site Suitability Evaluation Process
07/25/94	Design Review Package for 90% ESF Title II Package 1D
07/08/94	Transmittal of Study Plans: (1) Characterization of Site Ambient Conditions, (2) Characterization of Future Regional Climate Environments
07/01/94	DOE Submittal of Resolution of SCA Questions 35, 45 and 51
06/30/94	Transmittal of Topical Reports: Methodology to Assess Fault Displacement and Vibratory Ground Motion Hazards at a Yucca Mountain
06/23/94	Transmittal of Study Plan: Characterization of Yucca Mountain Unsaturated Zone in ESF
06/16/94	Submittal of Resolution of SCA Questions 5 and 20 and Comment 36
06/10/94	DOE Approach to Performance Objectives under 60.113(a)(2)
06/10/94	Submittal for Resolution of SCA Comments 5 and 80, and Questions 46 and 47

Figure 1: OCRWM Program Budget Changes FY 94-99



Data Source: Estimates from FY96 OMB Budget Request (October 12, 1994 Table)

* FY94-99 Figures Exclude Appropriations for
Civilian Waste R&D Activities





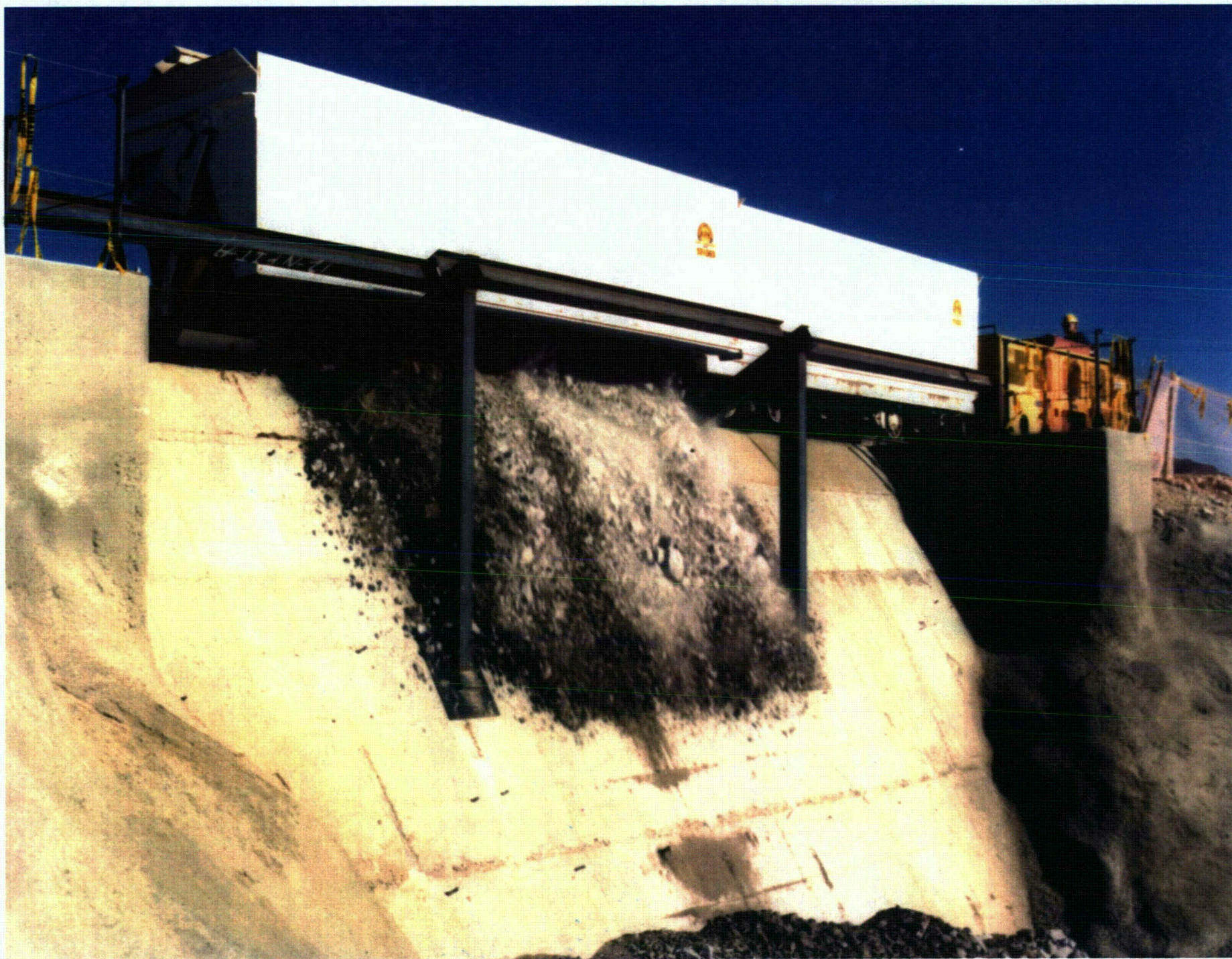
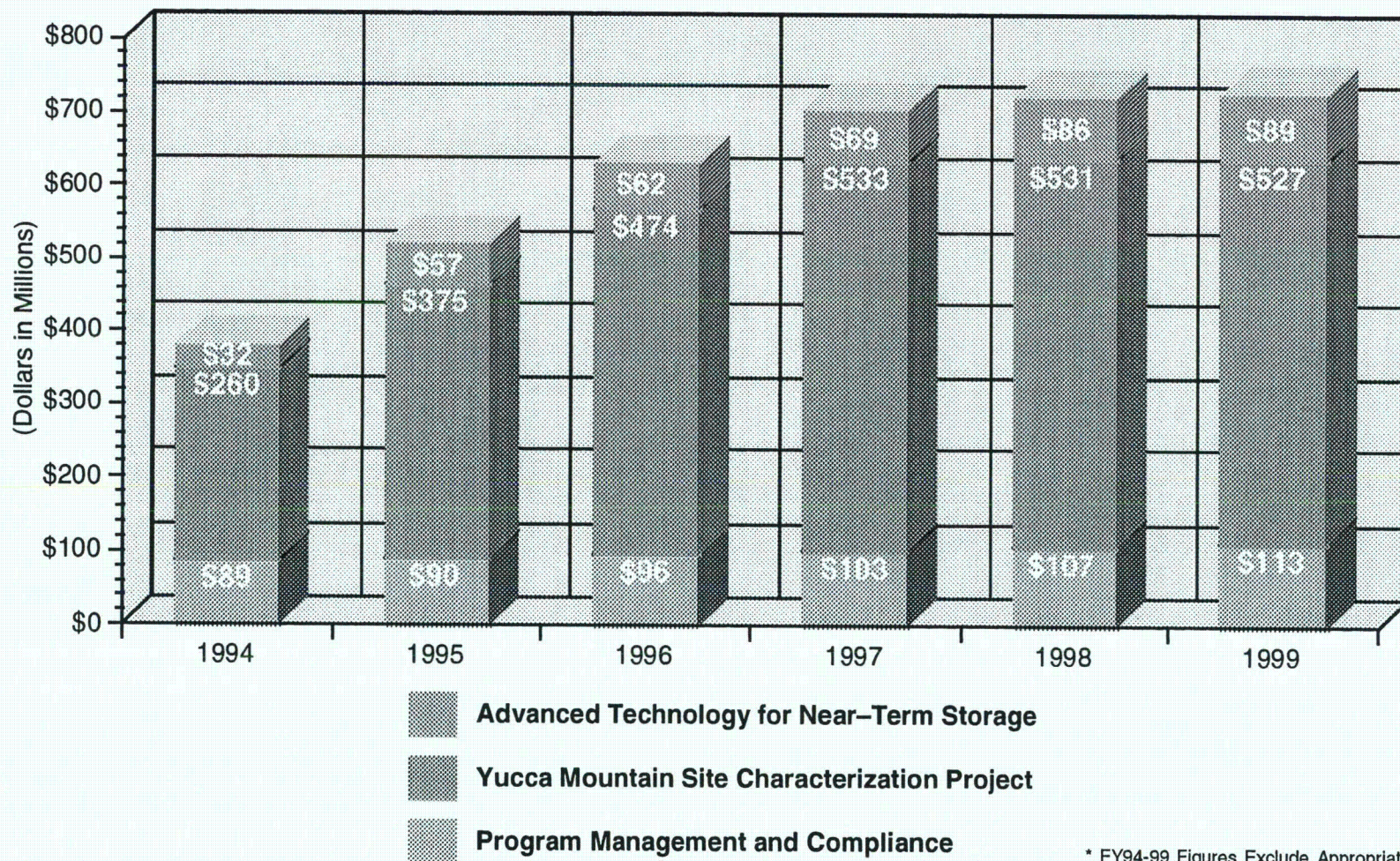




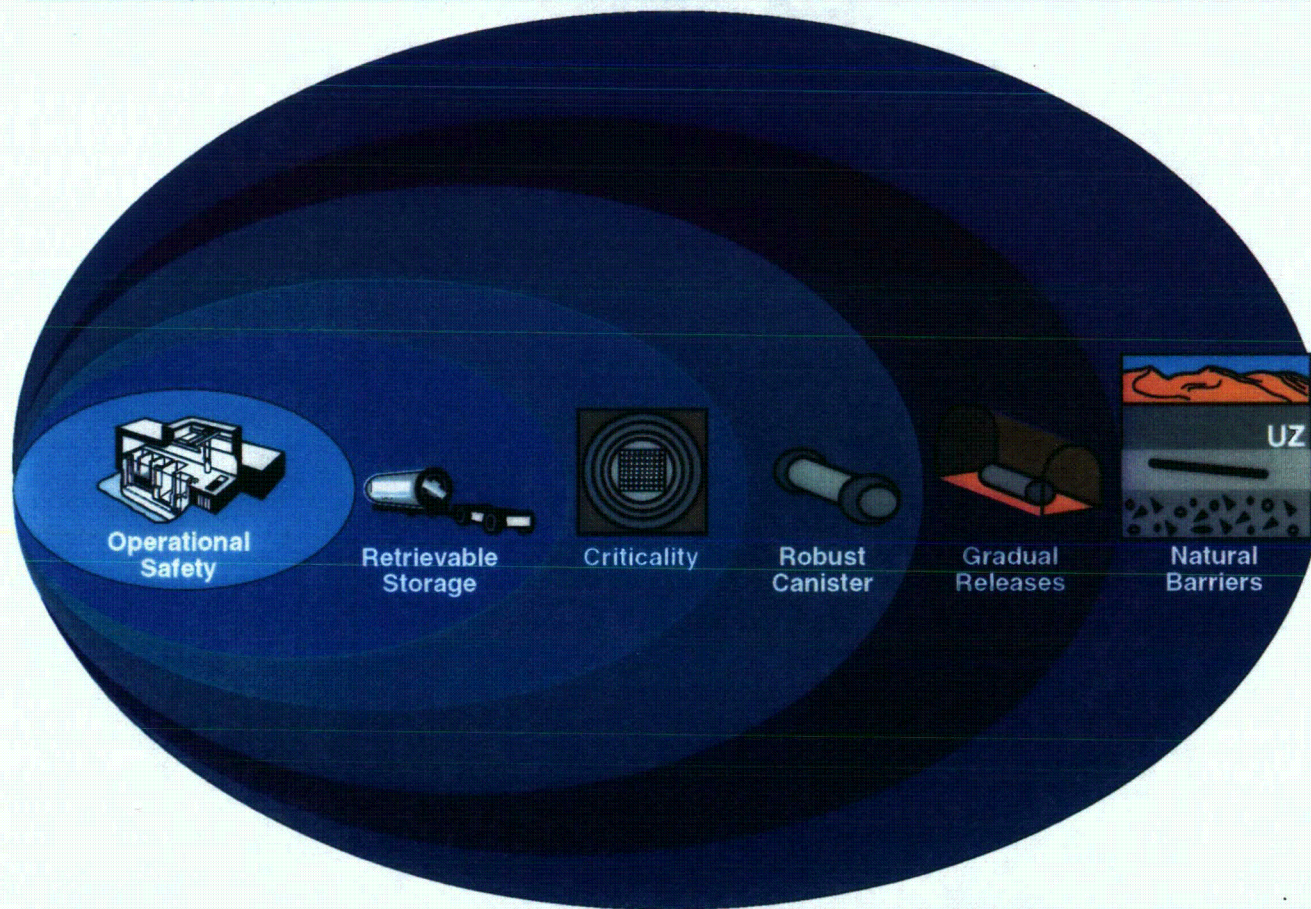
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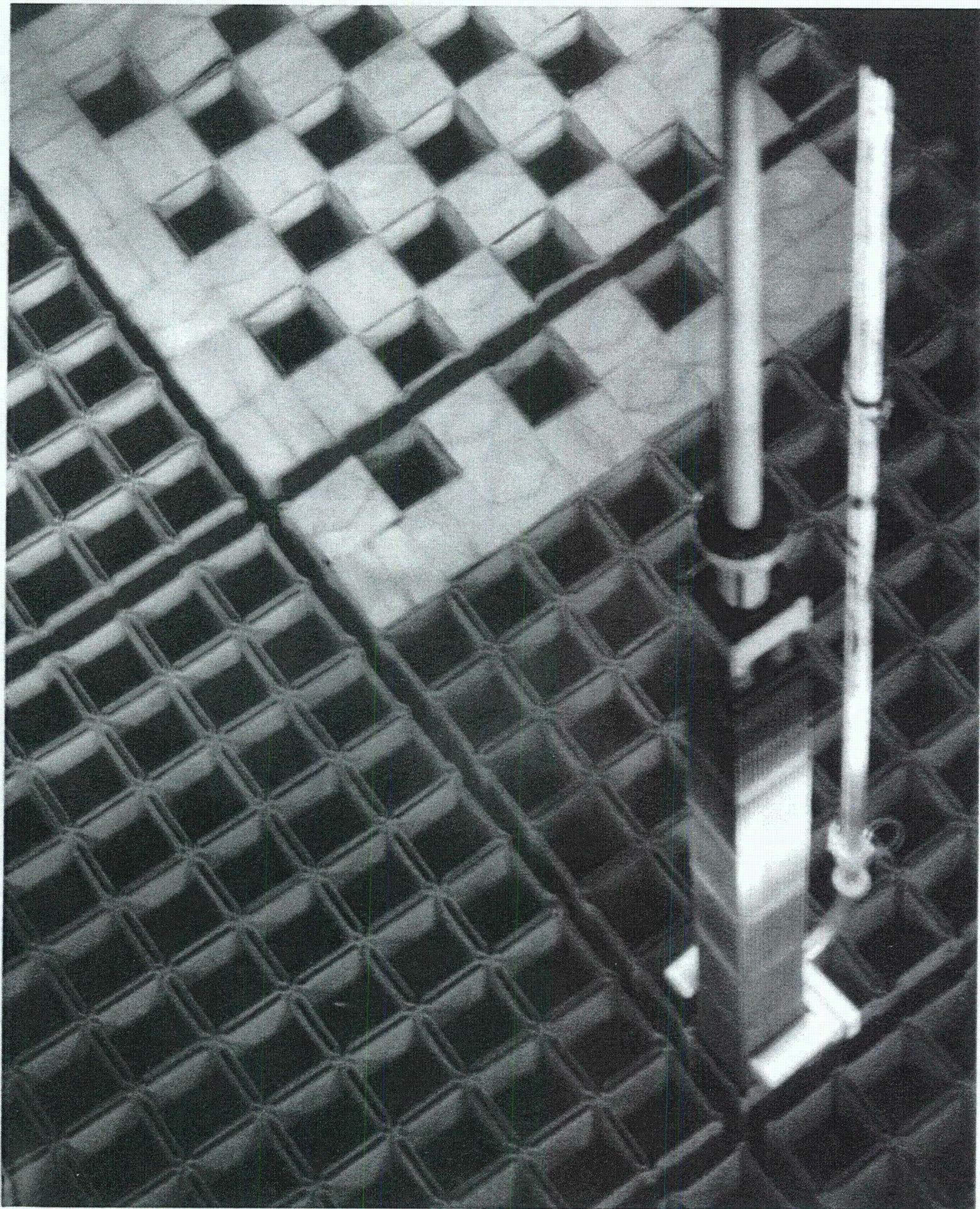
Defense in Depth/Ongoing Monitoring



Increasing Long-Term Confidence

NATIONAL ACADEMY OF SCIENCES/PEER REVIEW PROCESS QUESTIONS

- **Have the data been collected and analyzed in a technically acceptable manner?**
- **Do the data, given analytical and conceptual uncertainties support the technical interpretations and technical conclusions made in the report?**
- **Are there credible alternative interpretations that would significantly alter the conclusions reached?**
- **What testing, if any, would discriminate among alternative technical interpretations?**
- **If such testing is recommended, how effective would it be at reducing significant technical uncertainties?**



Burnup Measurement