

ORIGINAL

**UNITED STATES OF AMERICA**  
**NUCLEAR REGULATORY COMMISSION**

**Title:**           **BRIEFING ON STATUS OF ACTIVITIES WITH**  
                  **CNWRA AND HLW - PUBLIC MEETING**

**Location:**       **Rockville, Maryland**

**Date:**           **Wednesday, May 14, 1997**

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1 UNITED STATES OF AMERICA  
2 NUCLEAR REGULATORY COMMISSION

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4 BRIEFING ON STATUS OF ACTIVITIES

5 WITH CNWRA AND HLW

6 \*\*\*

7 PUBLIC MEETING

8 \*\*\*

9  
10 Nuclear Regulatory Commission  
11 Commission Hearing Room  
12 11555 Rockville Pike  
13 Rockville, Maryland  
14

15 Wednesday, May 14, 1997  
16

17 The Commission met in open session, pursuant to  
18 notice, at 1:33 p.m., the Honorable SHIRLEY A. JACKSON,  
19 Chairman of the Commission, presiding.

20 COMMISSIONERS PRESENT:

21 SHIRLEY A. JACKSON, Chairman of the Commission  
22 KENNETH C. ROGERS, Member of the Commission  
23 GRETA J. DICUS, Member of the Commission  
24 EDWARD McGAFFIGAN, JR., Member of the Commission  
25 NILS J. DIAZ, Member of the Commission

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1 STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

2 JOHN C. HOYLE, Secretary

3 KAREN D. CYR, General Counsel

4 MARGARET V. FEDERLINE, Deputy Director, Division

5 of Waste Management, NMSS

6 MALCOLM R. KNAPP, Deputy Director, NMSS

7 L. JOSEPH CALLAN, EDO

8 WESLEY PATRICK, President, CNWRA

9 MICHAEL J. BELL, NMSS

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

[1:33 p.m.]

CHAIRMAN JACKSON: Good afternoon, ladies and gentlemen.

The purpose of this afternoon's meeting is for the NRC staff and the Center for Nuclear Waste Regulatory Analyses, or we'll refer to it as the Center, to provide the Commission with a periodic briefing on the status of the NRC high-level waste program and activities of the Center.

The Commission is pleased to welcome Dr. Wesley Patrick, from the Center, who will be providing at least part of today's briefing. The last time the Center briefed the Commission was in April of 1996.

Today's briefing will be the first of three briefings on high-level radioactive waste that the Commission will receive in the next day and a half. Tomorrow morning the Commission will be briefed by the U.S. Department of Energy on its high-level waste program. At that briefing the Commission also will hear from representatives from the State of Nevada, local governments, and affected Indian tribes. Tomorrow afternoon the Commission will again be briefed by the NRC staff on the progress that has been made in the area of performance assessment for high-level waste disposal, as well as for low-level waste and for SDMP sites.

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1           Mr. Callan, the Commission looks forward to  
2   hearing from the NRC staff and the Center today on the  
3   status and accomplishments of the NRC's high-level waste  
4   program, and unless my fellow colleagues here have any  
5   opening comments, please proceed.

6           MR. CALLAN: Thank you, Chairman. Good afternoon,  
7   Commissioners. With me at the table this afternoon are Mal  
8   Knapp, the Deputy Director of NMSS; Wes Patrick, the  
9   president of the Center -- I'll use that same phraseology;  
10   Margaret Federline, the Deputy Director of the Division of  
11   Waste Management; and Mike Bell, a branch chief in  
12   Margaret's division.

13           Margaret Federline will lead the staff's  
14   discussion this afternoon.

15           Margaret.

16           MS. FEDERLINE: Thank you.

17           We appreciate the opportunity to be with you this  
18   afternoon to discuss our progress and accomplishments in the  
19   NRC high-level waste program. As I'm sure the Commissioners  
20   know, external factors and uncertainty still continue to  
21   influence the high-level waste program, and what I'm going  
22   to talk about today is our program strategy in the face of  
23   this uncertainty and how we see it meeting our statutory  
24   obligations.

25           Dr. Patrick of the Center is also here with me

1 today. Wes and I will describe some of the major technical  
2 progress that has been made in the program in spite of the  
3 constraints that we're facing. I also want to discuss our  
4 progress in meeting program objectives and provide some  
5 perspective on how we see the national program and it  
6 progress.

7 May I have the next slide, please?

8 May I have the next slide, please?

9 Because of the uncertainty and external influences  
10 on the high-level waste program, we feel it's really  
11 important to regularly review our program assumptions to  
12 ensure that we have the ship steered in the right direction.  
13 As you are aware, the Nuclear Waste Policy Act of '87 and  
14 the Energy Policy Act of '92 are currently the guiding  
15 statutes for the high-level waste program. You are of  
16 course aware of the legislation that's been introduced in  
17 Congress, S. 104, which has passed the Senate, and H.R.  
18 1270, which is under consideration by the House. We don't  
19 expect the key scientific issues at a potential Yucca  
20 Mountain site to change based on the passage of these key  
21 pieces of legislation. However, we can see that adjustments  
22 to the regulatory framework would be needed if these pieces  
23 of legislation do pass.

24 Another one of our key assumptions is that the EPA  
25 standard will be proposed in 1997 and finalized in 1998.

1 CHAIRMAN JACKSON: Do you have, you know, some  
2 sense of what level of confidence you can -- that you have  
3 that EPA would meet that, you know, actually promulgate a  
4 standard, a draft standard, this year?

5 MS. FEDERLINE: I would say we had more confidence  
6 about two months ago. They were telling us it was in a  
7 couple of weeks, but now the message that we're getting is  
8 it's uncertain as to when it will be published.

9 CHAIRMAN JACKSON: Now how would the NRC program  
10 or for that matter the whole high-level waste program be  
11 affected if, you know, assuming we're operating under the  
12 existing statutory requirements, how would that be affected  
13 if the standard were delayed beyond these projected dates?

14 MS. FEDERLINE: DOE has told us that they -- the  
15 standard could be on the critical path. They've told us  
16 that July 1999 is important for them to have NRC's standard  
17 in place, and I'm sure they've told EPA a similar thing.

18 CHAIRMAN JACKSON: Same thing.

19 MS. FEDERLINE: We believe that DOE will continue  
20 to implement its revised program approach. As you know, the  
21 appropriations language for 1997 directed DOE to focus on  
22 the core scientific issues, and we believe that this is  
23 consistent with NRC's refocused program. And of course  
24 future budget estimates are highly uncertain.

25 I would just touch on the next slide. My reason



1 for including it is to illustrate that both NRC and DOE have  
2 experienced significant reductions over the past two years,  
3 although as you can see from the chart, DOE's budget has  
4 been somewhat restored. The Commission requested the staff  
5 to continue on a path under DSI 6 to keep pace with the  
6 national program at an appropriate level of funding, and  
7 this has been difficult, and will continue to be difficult  
8 if current budget levels persist.

9 CHAIRMAN JACKSON: Yes, please.

10 COMMISSIONER McGAFFIGAN: A question on budget.  
11 If the current legislation, and the Chairman testified on  
12 this a few weeks ago, but if the current legislation were to  
13 move forward with either the House or Senate time line in  
14 interim storage came into the picture, we have nothing  
15 budgeted for that, and it would have to be budgeted in the  
16 high-level waste area, right? We would face a tradeoff  
17 between money devoted to the repository and money devoted to  
18 reviewing DOE paperwork related to interim storage. Is that  
19 correct?

20 MS. FEDERLINE: Yes, I think as the Chairman  
21 mentioned in her testimony in the hearing, that there is a  
22 pending collision of the programs in this --

23 COMMISSIONER McGAFFIGAN: Weird vapors, as --

24 CHAIRMAN JACKSON: Oh, yeah, running on --

25 COMMISSIONER McGAFFIGAN: Running on fumes.

1 CHAIRMAN JACKSON: Fumes. Yes, thank you so much.  
2 Those were my very words.

3 [Laughter.]

4 COMMISSIONER McGAFFIGAN: My recollection is that  
5 DOE as expected -- and this is not your office, so maybe  
6 Joe -- as expected did just submit something to us about a  
7 generic interim storage facility, and -- how much resource  
8 goes into reviewing, you know, their generic paper? Do  
9 you --

10 MR. BELL: We have two FTE's budgeted for the  
11 spent-fuel project office review, activities under the high-  
12 level waste fund, and that would fall into that area, and  
13 since we're already half -- more than halfway through the  
14 fiscal year, that should be adequate.

15 CHAIRMAN JACKSON: Okay.

16 MS. FEDERLINE: May I have the next slide, please?

17 We're entering a critical time in the repository  
18 program. For those of us who've worked in the repository  
19 program for a long time, it's a welcome sight to see the  
20 critical decisions approaching. I would note that decisions  
21 in which NRC will play a key role, I won't go into detail on  
22 each and every milestone, but I would just note that NRC has  
23 either a statutory responsibility to be involved in these  
24 milestones or in the case of the viability assessment, we  
25 expect the Commission to perhaps have views solicited on the

1     acceptability of the viability assessment. So as you can  
2     see, there are many activities coming down the pike for us,  
3     and this is the context that we want to present our program  
4     strategy.

5             The next set of the slides provides an overview of  
6     our refocused program, where we are currently in  
7     prelicensing concepts and where we see ourself going as we  
8     get closer and closer to licensing.

9             On slide 8, considering the approach of these  
10    important milestones for the national program, we've really  
11    identified three major goals which sort of drive the  
12    objectives that you have listed on the slide here.

13            The first is to provide a reasonable and  
14    implementable regulatory framework. We have been  
15    cooperating with EPA in the development of implementable  
16    safety standards. The NRC staff with the Center staff has  
17    been conducting detailed analyses and have provided these to  
18    EPA. I would just emphasize that we've not focused on this  
19    acceptability of the repository, but rather on the  
20    implementability of the regulations. We are also planning  
21    to come to the Commission with an options paper discussing  
22    how such regulations might be implemented in our regulatory  
23    framework so that we can ensure that any approach we're  
24    considering is consistent with the Commission's wishes.  
25    And, you know, as I emphasized earlier in the briefing, DOE

1 has indicated that they would like something in place by  
2 July of '99.

3 The other objective that I want to really focus on  
4 today is we've attempted to define a program strategy which  
5 focuses on what really makes a difference. You're aware  
6 that it's a very unique engineering and scientific problem,  
7 and there are a lot of issues that could be studied and  
8 studied and studied. What we're trying to do is using a  
9 systems approach through performance assessment get an  
10 understanding of what really makes a difference, and make  
11 sure that our comments are directed at those areas. And the  
12 objectives that I have listed on the slide that coordinate  
13 with that goal are to set program priorities based on key  
14 technical issues that are most important to repository  
15 performance. One of our key elements of our prelicensing  
16 strategy has been to communicate early with DOE. We don't  
17 want there to be any surprises when the Commission's asked  
18 for its comments on the viability assessment. We want it to  
19 be clear what our scientific programs are finding and what  
20 potential vulnerabilities we see for the licensing program.

21 We also have initiated a program to resolve key  
22 technical issues at the staff level prior to the viability  
23 assessment. I would just note that under the NRC/DOE  
24 procedural agreement resolving issues means that NRC staff  
25 has no additional questions at this point in time. It

1 doesn't preclude us from asking questions at a later point  
2 if new information comes up.

3           The other objective that I wanted to focus on was  
4 in reviewing elements of DOE's viability assessment and  
5 preparing to answer questions, we have felt that a focus on  
6 potential licensing vulnerabilities is the correct approach,  
7 and what we're trying to do is for each of the KTI's we  
8 would develop acceptance criteria, which would provide some  
9 guidance for DOE as well as for the NRC staff on what the  
10 NRC staff would find acceptable. And we're defining these  
11 acceptance criteria not only on a discipline basis, that's  
12 issue by issue, but on an integrated systems approach, so we  
13 make sure we consider the significance of the issue to  
14 performance at the time we develop the acceptance criteria.

15           And the third goal that I want to focus on on this  
16 slide is we've been working on improving our efficiency and  
17 interdisciplinary understanding of the processes that are  
18 going on at Yucca Mountain. What we have tried to do through  
19 involving greater numbers of staff in our systems analysis  
20 is to enhance their understanding of how their relative  
21 disciplinary knowledge fits into the big picture and really  
22 affects the end point, the compliance point, which is DOE's.

23           Another goal that we've set for ourselves is to  
24 never have an interaction that doesn't have a predetermined  
25 objective. We want to make sure that our interactions are



1 focused and well-defined, that we just don't get together  
2 for the purposes of getting together. We want to make sure  
3 that it's clear from DOE's side and clear from our side what  
4 we would like to accomplish.

5 CHAIRMAN JACKSON: Let me ask you a couple quick  
6 questions. Has the cooperation between the NRC and EPA  
7 staffs on the EPA high-level standard been favorable?

8 MS. FEDERLINE: I would say generally we made some  
9 good progress. We have not seen a copy of the draft  
10 standard recently. The last copy of the standard we saw did  
11 reflect some of the progress that we felt we had made, sort  
12 of an agreement and consensus on how to implement such a  
13 standard. There are two significant issues that remain, and  
14 we've discussed those with the Commission. This is the need  
15 for a separate groundwater protection standard as well as  
16 the level of individual protection that might be necessary  
17 at a repository. There are still remaining differences on  
18 those issues.

19 CHAIRMAN JACKSON: I was going to ask you about  
20 those. When do you actually plan to initiate the  
21 development of a risk-informed performance-based standard  
22 specific to, you know, rule specific to Yucca Mountain?

23 MS. FEDERLINE: Our plan is to come to the  
24 Commission in the early fall with an options paper that  
25 would outline some options for the Commission in terms of

1 revising the regulatory framework. We -- hopefully the  
2 Commission would give us early guidance at that point, and  
3 we really believe that we would like to go ahead and  
4 proceed.

5 CHAIRMAN JACKSON: And does your schedule for  
6 finalization of the rule track with the DOE schedule to  
7 submit a license application in 2002?

8 MS. FEDERLINE: Well, that's highly dependent on  
9 the availability of resources. If we are to --

10 CHAIRMAN JACKSON: So assuming you had the  
11 resources, what you've laid out would track with that is  
12 what you're saying?

13 MS. FEDERLINE: Yes. Correct.

14 CHAIRMAN JACKSON: Okay, but it's very resource-  
15 dependent.

16 MS. FEDERLINE: Yes, it is.

17 CHAIRMAN JACKSON: And the last question is, you  
18 mentioned improving program efficiencies, you know, as  
19 budget's been squeezed and squeezed. What other ideas do  
20 you have for improving --

21 [Laughter.]

22 MS. FEDERLINE: One thing we have worked with the  
23 organizational development staff in the Office of Personnel,  
24 and we are going through team training to help engineers and  
25 geoscientists speak to one another. As I'm sure you know,

1 they're very different disciplines, and each brings a  
2 special expertise to the program, and we just want to make  
3 sure that we are interfacing as effectively as we possibly  
4 can. Another efficiency that we've done in the Center has  
5 been a great contributor to this. We have revised our total  
6 system code to be much more user-friendly, and we have  
7 defined it so that more staff members can actually use the  
8 code. That allows us to conduct more sensitivity analysis  
9 in parallel, taking advantage of the various staff  
10 expertise. Now in the past we were forced to use a Cray  
11 computer at Idaho, but putting it on a work station in a  
12 work-station environment it allows us to have real-time  
13 feedback from the analysis.

14 CHAIRMAN JACKSON: Commissioner McGaffigan.

15 COMMISSIONER MCGAFFIGAN: Let me ask a couple  
16 followup questions to the Chairman's.

17 You said the last time you saw the EPA standard,  
18 am I accurate that that was some many months ago?

19 MS. FEDERLINE: Yes, my best memory is, let's see,  
20 it's probably been about 2 months, but I'd have to check.

21 COMMISSIONER MCGAFFIGAN: And the Academy of  
22 Sciences on the issues that are in disagreement our staff  
23 position is much more compatible with the NAS study's  
24 recommendations on this issue of groundwater and level of  
25 individual protection than the -- what we know of the EPA

1 position at this point?

2 MS. FEDERLINE: Yes, the National Academy on the  
3 issue of groundwater protection said they made no  
4 recommendation for a separate groundwater protection  
5 standard, so that is consistent, and our recommendation in  
6 terms of an adequate dose level was within the risk range  
7 the National Academy recommended.

8 COMMISSIONER McGAFFIGAN: Finally, there's this  
9 other actor in this area, and Nuclear Waste Technical Review  
10 Board, and the reason I'm raising the question now is it  
11 says other parties at the bottom here. How do you see the  
12 relationship between us -- their role as I understand it,  
13 set up in the 1987 act, is to advise the president and  
14 Secretary of Energy on -- as a separate, independent body on  
15 technical progress being made, and there seems to be a bit  
16 of an overlap there. They've made recommendations that are  
17 resource-intensive for DOE with regard to this east-west  
18 tunnelling. Did their recommendations ever get in the way  
19 of our recommendations as to where DOE should be focusing  
20 its resources in order to meet what we need, and how do  
21 issues like that get resolved?

22 MS. FEDERLINE: Well, we see the roles of the two  
23 organizations as somewhat distinct. The Nuclear Waste  
24 Technical Review Board in our mind is an independent group  
25 that was put in place to advise DOE on the operation of the

1 program. Our role is not to tell DOE how to run the  
2 repository program. Our role is more to serve as an  
3 independent regulator, to look at DOE's approaches to  
4 things, and to identify vulnerabilities that we would see  
5 for licensing.

6 So we really see the roles quite differently, and  
7 the recent -- the recent report that came out from the Board  
8 I think was a good example of that. You know, they were  
9 emphasizing the importance of an east-west drift and the  
10 operational aspects of looking at enhancements to the waste  
11 package design, and also looking at transparencies. I don't  
12 think we see inconsistencies, but I would just say in terms  
13 of an east-west drift, GAO had talked to us about this a  
14 couple of months ago, and we had explained that NRC does not  
15 see a need to dictate the necessity. We see the value in  
16 collecting additional information. So we don't see  
17 ourselves in conflict with the Board, but we would not make  
18 such a requirement.

19 CHAIRMAN JACKSON: And so you've not seen any  
20 evidence of competing priorities in terms of what they may  
21 be trying to do to work with us vice the recommendations of  
22 this Board?

23 MS. FEDERLINE: Let me just ask Mike Bell if he  
24 would like to add anything.

25 MR. BELL: Yes. Actually there have been cases in



1 the past where essentially they help reinforce a staff  
2 position. For example, originally DOE was planning to sink  
3 vertical shafts to construct the exploratory studies  
4 facilities. The NRC staff first suggested they consider  
5 ramps, and then some time later that was also recommended by  
6 the Technical Review Board, and eventually DOE in fact  
7 changed their program.

8 COMMISSIONER McGAFFIGAN: That brings up the issue  
9 of is there a way to leverage them, given how -- I mean, we  
10 may be already on fumes in some of our core programs here,  
11 and they have -- I don't know what their budget is, the  
12 Nuclear Waste Technical Review Board budget, but they are  
13 independent of DOE, we're independent of DOE, we have a  
14 regulatory function, they have an advisory function. Have  
15 you thought about whether there's any efficiency in trying  
16 to leverage them more than we have thus far?

17 MS. FEDERLINE: Yes, we have. We approached the  
18 staff of the Technical Review Board with our issue  
19 resolution strategy to see if there's a way that we could  
20 try and coordinate meetings. Meetings can be a big sink in  
21 time and resources and, you know, looking at based on DOE's  
22 waste isolation strategy if we might have meetings so we  
23 could get our information and they could get their  
24 information, and we have a very good working relationship  
25 with the staff at the Review Board.

1 CHAIRMAN JACKSON: Please.

2 COMMISSIONER ROGERS: On the key technical issues,  
3 is there an agreement now with DOE as to what they are? At  
4 one point we were in disagreement on a couple of issues, and  
5 do we now have a common set that we agree are the key  
6 technical issues?

7 MS. FEDERLINE: I think DOE continues to place  
8 less emphasis on the disruptive processes. We did have a  
9 recent technical exchange on igneous activity and we  
10 discussed some agreements in that regard, but I think  
11 there's a feeling on the part of the NRC staff that we need  
12 to at least work through to consequences on disruptive  
13 events, because they are the potential for high-consequence  
14 events, and as a responsible regulator, we need to make sure  
15 that things that could result in more serious exposure truly  
16 are a lower-risk event. So I think there may be a mismatch.  
17 I think DOE believes that this issue, you know, does not  
18 warrant much more consideration. Although we did agree --  
19 in our last technical exchange they agreed that more  
20 consequence analysis did need to be done, and they're going  
21 to set about doing that.

22 COMMISSIONER DIAZ: We're talking about  
23 consequences and igneous activity. You're looking at this  
24 probability, of course.

25 MS. FEDERLINE: Yes.

1 COMMISSIONER DIAZ: And isn't that probability  
2 very low for that area?

3 MS. FEDERLINE: Yes, it is, and we believe that  
4 we're at the point where we can agree on what the range of  
5 probability is, but this is just to keep in mind their own  
6 peer-review panel identified that there are three orders of  
7 magnitude of uncertainty in their range of probability. So,  
8 you know, there are significant uncertainties in these  
9 numbers, but I think we have -- we are comfortable at this  
10 point agreeing on the probability.

11 Next I wanted to touch on our current program  
12 strategy.

13 May I have slide 9, please?

14 Thanks.

15 We believe that the focus on key technical issues  
16 is still the right strategy at the current funding levels to  
17 ensure that vulnerabilities are identified for the viability  
18 assessment. As you are aware, budget constraints have  
19 forced us to eliminate the Center support in three key  
20 technical issues -- that's design, source term, and  
21 radionuclide transport. Now we have great concern about  
22 this, because from a technical perspective, I think we  
23 believe that all of the technical issues, key technical  
24 issues, are very important, and it was very hard for us to,  
25 you know, eliminate any of the issues, but --

1           CHAIRMAN JACKSON: Do you have any contingency  
2 plans for how to bound them or deal with them?

3           MS. FEDERLINE: Yes. This is -- currently we are  
4 addressing -- design we deferred because we felt that there  
5 was more flexibility in the future on design. In the area  
6 of source term and radionuclide transport we are addressing  
7 as part of our performance assessment some of the key  
8 sensitivities to really understand how severe the problem  
9 could be, which would then go back into our prioritization  
10 process, and we may start those KTI's. But I would just  
11 emphasize that under the \$17 million program that we've  
12 requested we could pursue all ten KTI's.

13           I'll just touch very quickly. As I said, one of  
14 our main goals is prompt feedback to DOE. I've identified  
15 three ways that we're doing that. I'll discuss the annual  
16 progress report in a little more detail in a future slide.  
17 We are developing issue-resolution status reports. For each  
18 KTI we will be preparing a report which documents our views  
19 on DOE's path to resolution and perhaps presents our own  
20 path to resolution. Through doing this we will define  
21 acceptance criteria which we will use to review the  
22 viability assessment. We actually believe that our  
23 interactions have been more fruitful. The focused nature of  
24 the interactions has been beneficial, and we're trying to  
25 make sure that we actually understand what each other are

1     trying to say before we send letters back and forth and  
2     people become more entrenched in their positions.

3             May I have the next slide, please?

4             COMMISSIONER ROGERS: Yeah, just before.

5             MS. FEDERLINE: Sorry.

6             CHAIRMAN JACKSON: Please.

7             COMMISSIONER ROGERS: Before you leave that, on  
8     the question of design, our position as I understand it has  
9     been that we really want to see that the entire design is  
10    conceptually fairly well defined in arriving at our  
11    conclusions with respect to the Center. So how are design-  
12    related issues being dealt with if the Center doesn't have a  
13    program in this?

14            MS. FEDERLINE: Well, we have concern about that,  
15    because we only have one staff member who is focusing on  
16    design at this point in time.

17            Let me just ask Mike Bell to add anything that he  
18    would like to add.

19            MR. BELL: Well, as Margaret mentioned, although  
20    the Center support and design area has been eliminated this  
21    fiscal year, we are still trying to do what we can with in-  
22    house staff, and one important aspect of the repository  
23    design that we have under review is a topical report DOE  
24    submitted on their seismic-hazard design which the review is  
25    progressing very well, and we think we're close to resolving



1     that question, and it's an example of an area that I think  
2     has worked quite well.

3             DOE came in to us because they wanted to use a  
4     probabilistic seismic hazard assessment methodology. We had  
5     some exchanges with them. Eventually I sent them an issue  
6     resolution status report agreeing with the methodology, and  
7     they're in the process of conducting a expert elicitation on  
8     that topic, which is following guidelines that we sent out  
9     and a branch technical position on expert elicitation, and  
10    so I guess we think with the resources we have, we're trying  
11    to do all the necessary things to be responsive to the  
12    things that are important to the DOE program at this time,  
13    but it's going to be hard to keep up if the Department's  
14    program keeps growing and we're straight-lined.

15            MS. FEDERLINE: I think this issue just makes the  
16    bottom point on my slide, that the \$17 million request for  
17    '98 is really critical to be able to work on all and key  
18    technical issues.

19            COMMISSIONER DIAZ: It's just a continuation of  
20    the same question and the priorities when the priorities are  
21    established. Of course I imagine every year you set the  
22    priorities.

23            MS. FEDERLINE: Yes.

24            COMMISSIONER DIAZ: And it seems to me like the  
25    design and source term, radionuclide transport are very

1 important priorities. You know, how do they get placed when  
2 our, you know, resource allocation seems to me a very  
3 critical issue.

4 MS. FEDERLINE: Yes.

5 COMMISSIONER DIAZ: And I don't know whether  
6 they're being revised or you have, you know, the terms in  
7 that they are now more important. In other words, we might  
8 only have money for seven or eight.

9 MS. FEDERLINE: Right.

10 COMMISSIONER DIAZ: But the question is which  
11 seven or eight, and I know that at the beginning there is,  
12 you know, some exploratory research and some issues that  
13 come, but eventually you have to come to the bottom line.

14 MS. FEDERLINE: That's right.

15 COMMISSIONER DIAZ: Like these issues are kind of  
16 the bottom line.

17 MS. FEDERLINE: Right. Just to give you just a  
18 quick glimpse into our prioritization process, we've worked  
19 very hard to get to the point where our system code can have  
20 enough substance to it where, you know, we can really count  
21 on our sensitivities and importance analysis. We're  
22 scheduled to complete those analyses late in the summer, and  
23 in the fall we will have the sensitivity analysis to help us  
24 prioritize. But another sort of measure that we use is  
25 tying it to the DOE program. In other words, DOE had told

1 us that they were not going to rely on sorption. And so  
2 that was one of the reasons why we ascribed a lower priority  
3 to radionuclide transport. They're now, I believe, going to  
4 depend more, so in our upcoming prioritization I think a  
5 reprioritization of the is going to be required.

6 Now because the licensing review will focus on the  
7 complete license application, it'll be necessary to examine  
8 other issues. These preclosure safety issues will be  
9 important as well as postclosure. So at the end of  
10 viability assessment we feel that it's necessary to shift to  
11 what we call the comprehensive approach. This will allow us  
12 to pursue the other statutory requirements such as the  
13 comments on the sufficiency of at-depth characterization and  
14 waste form which are to accompany the President's  
15 recommendation, as well as to review and adopt DOE's  
16 environmental impact statement.

17 Now you may question how is the comprehensive  
18 approach different than the current refocused program. We  
19 believe that the comprehensive approach will need to include  
20 refined independent performance assessments. This will be  
21 our complete review methodology for postclosure issues. We  
22 also believe it's necessary to develop a standard review  
23 plan for the license application review.

24 As I mentioned, we're developing acceptance  
25 criteria for postclosure for use in the viability

1 assessment, but we need to develop a full review plan for  
2 the licensing -- review of the license application. And we  
3 also feel that increased focus on quality assurance  
4 activities are necessary, and we're currently recruiting  
5 additional resources in this area right now.

6 As you'll recall, early on in the program we had  
7 concerns about DOE's QA program. They did strengthen their  
8 program significantly, and we think they're on the right  
9 track, but I think as we've learned in other regulatory  
10 experience in this agency, lack of attention to QA is a bad  
11 plan. So we want to make sure that we have the right focus  
12 there.

13 CHAIRMAN JACKSON: With the main tunnel at Yucca  
14 Mountain completed, is there a basis for this at-depth site  
15 characterization, you know, moving that forward in any way?

16 MS. FEDERLINE: Yes, the primary data for the at-  
17 depth site characterization and waste form will be from the  
18 exploratory facility. DOE has shifted an additional about  
19 \$10 million into the experimental program to collect some  
20 information on saturated and unsaturated flow, which is a  
21 key issue at the site, and so we'll also want to have the  
22 benefit of that in our --

23 CHAIRMAN JACKSON: So that's being moved forward  
24 to be done earlier than originally planned?

25 MS. FEDERLINE: Yes. Yes, additional resources.

1 CHAIRMAN JACKSON: Yes.

2 COMMISSIONER McGAFFIGAN: The standard review  
3 plan, if I were DOE I'd want to have that in good time  
4 before I submitted license application in 2002. What is the  
5 current plan for when the standard review plan would be --  
6 would be completed, so that the, you know, I would know how  
7 to structure my application?

8 MS. FEDERLINE: Our current plan is to have  
9 acceptance criteria for the postclosure done by the time of  
10 viability assessment. It will take us and depending upon  
11 budget levels -- we have different assessments depending  
12 upon the budget level -- it could take up to an additional  
13 three years to complete the review plan. So, you know,  
14 this -- depending upon budget uncertainty, this is an area  
15 where we could be on the critical path.

16 COMMISSIONER ROGERS: Commissioner Diaz.

17 COMMISSIONER DIAZ: Yes, I just, really on the  
18 same question, I, since this is kind of a unique case, I  
19 wonder if the standard review plan as you're developing has  
20 some clear objectives and milestones, because it might be  
21 that it's sometimes more important to get the work done  
22 timely than just a review plan, but I have no idea how it's  
23 actually --

24 MS. FEDERLINE: Right. The standard review plan  
25 is growing out of our work -- our work on the postclosure

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1 issues. We've not even been able to focus on preclosure  
2 safety issues at this point in time. So, you know, this  
3 will depend upon, you know, the budget level that we're  
4 seeing. And the EDO has requested us to look at some  
5 options and, you know, more information will be available on  
6 that.

7 COMMISSIONER ROGERS: Please proceed.

8 MS. FEDERLINE: I wanted to touch on one subject  
9 that you requested in the SRM on the meeting. When our  
10 budget was reduced from \$22 million to \$11 million in 1996  
11 we had to make some severe cuts, and the way we did that,  
12 managers from the Office of Research, from NMSS, and from  
13 the Center sat down and laid out all the activities that we  
14 believed would be needed before licensing, and sort of  
15 worked through a prioritization in terms of what activities  
16 needed to be completed and were most important. And in  
17 doing that we found it necessary to reduce some of the  
18 research projects, all but the highest priority research  
19 projects could not be fully funded.

20 The group of managers also recommended that to  
21 achieve some efficiencies that the management of the  
22 technical assistance and research should be consolidated  
23 under one organization, and this was recommended to the EDO,  
24 and of course the Commission was advised of this. And in  
25 your SRM you asked us for an appraisal, you know, of how

1 this was working.

2 Well, I think all of us would prefer to have a  
3 fully funded research program. That's entirely desirable in  
4 a program of this nature. But I think under the research --  
5 or under the budget constraints that we're experiencing at  
6 the current time, this was the only option that was open to  
7 us.

8 Now research has initiated a generic environmental  
9 transport research program, which we think will be very  
10 important. It will be broadly applicable to all the waste  
11 management programs. We think that is an advantage, and  
12 John Greeves and I not too long ago met with the management  
13 of the Office of Research to review the status of this  
14 generic program, and in a way this more closely parallels  
15 the traditional role with research performing generic  
16 activities and the licensing office doing site-specific  
17 activities.

18 Let me turn to --

19 COMMISSIONER ROGERS: Is the Center involved with  
20 that work?

21 MS. FEDERLINE: The Center is involved in  
22 receiving feedback from the work that is going on, but they  
23 are not conducting the work for the Office of Research.

24 I just wanted to note on this slide just some  
25 efforts that we're making to make sure that the independent

1 expertise that's available in the Office of Research is  
2 brought to bear on our waste management problems. NMSS,  
3 we're continuing to work together. As a matter of fact,  
4 there was an Appendix 7 at the University of Arizona to look  
5 at some extraction techniques from TUF, and the Office of  
6 Research participated. Even though they have a very limited  
7 budget, they contributed their expertise to that.

8 Research does monitor activities. They attend the  
9 weekly branch chief meetings and the weekly Yucca Mountain  
10 team meetings, and of course we provide them with copies of  
11 products and Center reports. We do participate in their  
12 research workshops when possible. As the generic research  
13 advances, we hope to have an annual meeting where we can  
14 have a dedicated exchange on the generic research that's  
15 being conducted.

16 May I have the next slide, please?

17 COMMISSIONER McGAFFIGAN: Does this generic  
18 research activity get funded out of high-level waste, or is  
19 it funded out of the appropriated budget that we get  
20 separate from --

21 MS. FEDERLINE: Yes, it's funded out of the  
22 appropriated budget, not high-level waste.

23 Next I wanted to turn to what we feel has been  
24 significant progress in meeting the program objectives. On  
25 slide 14 I wanted to talk about one of our new products. In



1     fiscal year '96 we produced an annual progress report, and  
2     this was an attempt to describe in an integrated fashion all  
3     of our technical work and show how it relates to DOE's waste  
4     isolation strategy, and define what we see as the path  
5     forward to resolution of these issues. We've had several  
6     meetings with DOE. We introduced the report to DOE, and  
7     we've recently discussed it in a management meeting, and our  
8     feedback that we're getting is that they've found that it  
9     was useful and it facilitated a dialogue on the issues.  
10    It's been a top seller. We're thinking of selling copies to  
11    fund the high-level waste program.

12                 Now I'd like to turn to Dr. Patrick, who will  
13    summarize some of our key areas of progress.

14                 DR. PATRICK: Thank you. I appreciate that.

15                 Chairman, Commissioners, the remainder of our  
16    briefing today I'd like to focus on what we feel to be  
17    rather significant progress that we've made, both the Center  
18    staff and the NRC staff over this past year, and some plans  
19    that we have looking out ahead in meeting some of the high-  
20    level waste program objectives.

21                 I'm going to start with an overview of the  
22    progress, touch briefly some comments on our plan for the  
23    future, a few general views about the DOE program at this  
24    stage, and hopefully in doing that to lay out a framework  
25    for the remainder of the discussion, which will be to

1 present in four broad program areas some specific examples  
2 of progress that we've made.

3 There are a number of bullets on those charts.  
4 I'll probably be touching on just a few of those, and would  
5 encourage and be open to your questions on those that I  
6 might not have put high priority on in addressing here. I'd  
7 certainly be happy to cover those.

8 Slide 15, please.

9 We dedicated our efforts during FY '96 to  
10 establishing what we consider to be a sound technical basis  
11 for proceeding with issue resolution. Those considerations  
12 and those efforts have continued in early FY '97, and as  
13 Margaret has indicated, we're going to be later this summer  
14 initiating a series of detailed sensitivity analyses that we  
15 believe will be instrumental in doing several things which  
16 I'll be touching on a little more as we move through the  
17 discussion.

18 If you look at the second, third, and fourth  
19 bullets there, they highlight three broad areas where I feel  
20 that we've made significant progress if you look in broad  
21 brush. First, we've improved our understanding of a number  
22 of very critical processes, critical from the standpoint of  
23 repository performance, things like igneous activity. This  
24 has been done through review of a variety of sources of  
25 existing data as well as collection of some selected new

1 data ourselves.

2 Second, we've enhanced or completed the models for  
3 representing those processes, again, processes that are  
4 important to performance. We've developed an ash dispersion  
5 model which will be instrumental in understanding the second  
6 part of the risk equation that you alluded to earlier,  
7 Commissioner Diaz, to understand not only the probability  
8 but to get at the consequences portion of that issue. We've  
9 also done development in the container corrosion and we'll  
10 speak to that as a specific example a little bit later on in  
11 the presentation.

12 The third areas that we will be conducting  
13 sensitivity studies on some of the individual repository  
14 systems and processes that are believed to be important to  
15 performance. We're going to have the results of those  
16 studies appear in two key documents, the annual report,  
17 which was just alluded to, for FY '96. We'll be doing  
18 another one of those reports this fiscal year as well. And  
19 then within these ten key technical issues we'll be  
20 publishing issue resolution status reports where we will use  
21 these sensitivity analyses to try to understand better what  
22 the priorities for future work should be, and also to  
23 determine which ones of those subissues can be closed  
24 because we have determined at this point that there are no  
25 further questions, that the sensitivity is such that we

1 understand that particular subissue well enough to set it  
2 aside until we move forward into the licensing process.  
3 Again, recognizing that there is the option as new  
4 information, new understandings become available, as the  
5 designs are solidified and come forward to us from DOE, that  
6 we will once again examine and be sure that our initial  
7 findings are appropriate and are substantiated.

8 We feel that the approach we're taking here has  
9 been quite successful. There's been progress in three  
10 particularly notable issues closing in on the tectonic  
11 models that are applicable for the site, coming to an  
12 agreement on the probability of extrusive vulcanism at the  
13 site, and the one that Mike Bell alluded to earlier,  
14 developing and coming to agreement on a seismic design  
15 methodology. We're very close to closure on that issue as  
16 well.

17 Slide 16, please.

18 Just kind of carrying over from 15, unable to show  
19 both of these at the same time, but one of the last items  
20 there, which carries over onto slide 16, deals with the  
21 broad area of total system performance assessment. This has  
22 been an area where significant effort has been devoted by  
23 both of our staffs. We've been involved in developing a new  
24 version of the code.

25 Several of you will be familiar with the general

1 approach that we've embarked on a number of years ago. We  
2 use the phrase iterative performance assessment, indicating  
3 the evolutionary iterative process that is needed to address  
4 a complex issue like this where information is evolving both  
5 about the site and about the design as well as the  
6 performance standard against which the eventual performance  
7 of the repository will be judged.

8 Those code modifications this year have focused in  
9 several areas. We have tried to incorporate in the new code  
10 not only some enhanced models with respect to this geology,  
11 but we have also made some improvements with regard to  
12 including some of DOE's new design considerations. The  
13 previous version of the code, for instance, had a vertical  
14 emplacement. That was the design that was in vogue at the  
15 time. We've since revised that to consider DOE's more  
16 recent in-drift emplacement. And of course to be able to  
17 make this code more efficient for a broader base of this  
18 staff to use it and operate with it, we have moved it onto  
19 the p.c. platforms, able to use this on your advanced  
20 computer system, and with that we have had to make some  
21 improvements in the computational efficiency of that code.

22 The version 3 of the code will be very shortly in  
23 this hands of a very broad cross-section of the staff. You  
24 have a number of staff who are currently involved in  
25 reviewing and evaluating this version of the code that we

1 delivered in mid-March. We hope by early summer to have  
2 completed the development and refinement of that code and  
3 turned it over for the sensitivity analyses and importance  
4 analyses that will be conducted not only by your staff here  
5 at White Flint but also by Center staff members.

6 COMMISSIONER McGAFFIGAN: Is this code available  
7 to the public, if somebody at a university wanted to be  
8 looking at the same sorts of issues?

9 MR. PATRICK: The code has not yet reached a point  
10 where we have put it under version control and have  
11 solidified it as a code which we would be comfortable I  
12 think either from a regulatory perspective or technical  
13 perspective in releasing it. The specifics with regard to  
14 release I would defer to NRC management on what their plans  
15 might be there. We did not release TPA version 2, but 3 I  
16 guess we've not discussed.

17 MS. FEDERLINE: That's correct, we've not made a  
18 final decision, but our general policy is under our  
19 procedural agreement that we would share the code with  
20 interested parties.

21 MR. PATRICK: I would note in an allied area there  
22 are other codes, detailed system-level codes, which we have  
23 completed development on, developed user's guides. NRC has  
24 made decisions on a case-by-case basis to release those to  
25 the public or to allow the Southwest Research Institute, the

1 Center, to copyright those and make those available.  
2 Regardless of which path is followed, there's a provision in  
3 the copyright that allows any party to the NWPA to gain free  
4 access to that code, as well as your staff to have access to  
5 it. So that is a part of the puzzle that we have worked,  
6 but the total system.

7 Touching on that first bullet on slide 16, we feel  
8 that in addition to its purely technical role, the total  
9 system performance assessment code and the analyses that we  
10 do with it fulfill some very important decision-aiding  
11 processes. It's a tool box in that sense. It has enabled  
12 us to and continues to enable us to reevaluate the  
13 importance of the various technical issues that are under  
14 consideration. It's the only tool we have available that  
15 allows us to do that in a quantitative way, to move beyond  
16 the qualitative judgments that we feel confident in making  
17 but only reasonably confident until we have made an  
18 assessment against risk. It also is providing us with the  
19 basis to develop a risk-informed performance base acceptance  
20 criteria which appear first in our issue-resolution status  
21 reports and which we believe will be instrumental in both  
22 development of the standard review plan and also in  
23 assisting in the eventual development of a Yucca Mountain-  
24 specific regulation.

25 And finally, it's being used as a very important

1 tool to help us develop the methods that we will use to  
2 conduct various reviews, starting with a viability  
3 assessment and a site-suitability report and so forth on  
4 through the construction authorization process.

5 I've noted here a couple of vehicles that are very  
6 important in communicating with the Department of Energy and  
7 documenting the progress that we're making as well.

8 COMMISSIONER ROGERS: When do you expect to have  
9 that completed, that work on risk-informed performance-  
10 based acceptance criteria?

11 MR. PATRICK: That is an ongoing process. We  
12 anticipate having the first round of issue resolution status  
13 reports completed late this calendar year or early next  
14 calendar year is the current schedule I believe that  
15 we're --

16 MS. FEDERLINE: Yes.

17 MR. PATRICK: We want to have information in DOE's  
18 hands about six months before the viability assessment comes  
19 in. And with the current resources and the current schedule  
20 we're working to and realizing that this is all being pushed  
21 by the development of the TPA code as well, that's -- I  
22 think we can make that kind of a schedule.

23 Slide 17, please.

24 Turning now to some general views on the DOE  
25 program at this point, and I'll try to focus primarily on



1 technical issues, but there are always programmatic  
2 implications to those. I would say that our most important  
3 observation is that there has been a very clear improvement  
4 in DOE's overall program management and planning process.  
5 An example of that was alluded to earlier, where we're  
6 seeing a flexibility to reallocate resources. As they did  
7 some of their performance assessments and began to realize  
8 the credit that they would need to take, want to take, for  
9 mixing in the saturated zone, they have now directed  
10 resources to examine in better detail how the saturated zone  
11 behaves in the vicinity of Yucca Mountain, and we're very  
12 pleased to see that sort of responsiveness.

13 Likewise, I think the communication between NRC  
14 and the Center staffs and DOE has improved. That's come  
15 about through focusing all of our interactions, having very  
16 clear objectives for each of those. I would cite several  
17 very important examples. We had an appendix 7 meeting on  
18 tectonic processes where DOE, Center, NRC, and State was  
19 represented. Very important in terms of narrowing down the  
20 very broad range of processes we're examining. The seismic  
21 design methodology and the igneous activities technical  
22 exchange would be similar examples in that area.

23 Certainly the completion of the exploratory  
24 studies facility has been a major milestone for DOE, and it  
25 has opened up in both a figurative and literal way access to

1     seeing the geology and allowing DOE to make measurements,  
2     not so much in the tunnel itself but in the various alcoves  
3     that have been developed. And we continue through the NRC's  
4     on-site representatives and through various interactions  
5     with the Department of Energy staff and its contractors to  
6     follow very closely the testing that they are doing, the  
7     designs of those tests, as well as the results that are  
8     coming out of those.

9             CHAIRMAN JACKSON: Is DOE conducting surface  
10    tests?

11            MR. PATRICK: Surface-based testing continues.  
12    They've one area that they've reached a conclusion in.  
13    They've completed their trenching activities and actually  
14    have made a decision to begin backfilling a number of those  
15    trenches.

16            That brings to mind another point of coordination.  
17    That was coordinated very carefully. NRC staff had an  
18    opportunity to give them feedback as to whether the NRC  
19    needed additional information from those trenches before the  
20    bulldozers moved in and filled them back in again. So I  
21    think it was another area that worked quite well.

22            Yes, certainly the sea well complex of surface-  
23    based testing, looking at both reactive and nonreactive  
24    tracer testing at that complex is an important surface-  
25    based testing.

1           One of the items that we alluded to earlier, just  
2   to touch on that last bullet, we've seen substantial  
3   progress in the quality-assurance area. This has been an  
4   issue between the NRC and DOE staffs from the outset. It's  
5   one of the original objections that was filed when the site  
6   characterization plan was submitted. We've seen significant  
7   progress there in some very measurable areas. They're  
8   developing what they call a binning process, which will help  
9   not just in this quality assurance area of applying a graded  
10   quality assurance approach, but it'll help greatly in this  
11   design process.

12           And I might note that some of the areas that Mike  
13   alluded to earlier, the focus of activities there on DOE's  
14   are going to be in the novel areas of design. They, like  
15   us, given the constraints that they have, are not going to  
16   pay great attention coming into viability assessment.  
17   They're not going to pay great attention to things that they  
18   believe can be handled in a routine fashion based on  
19   existing engineering capabilities within their organization  
20   and their contractor group.

21           Slide 18, please.

22           I mentioned moving into a brief discussion on four  
23   areas where we have made significant progress. The first of  
24   those deals with NRC progress and views on this site  
25   characterization program. That's the first of the four

1 areas I'd like to touch on.

2 Staff work including some limited field studies,  
3 probabilistic volcanic hazard analysis conducted by the  
4 Department of Energy and technical exchanges on this  
5 subject, as well as a follow-on meeting with the Advisory  
6 Committee on Nuclear Waste, have moved us to the position  
7 where we are able to reach agreement on the probability of  
8 extrusive vulcanism. We're concluding that the probability  
9 is low, but not so low that we cannot give attention to the  
10 consequences. So there's an issue, a very visible one,  
11 where we believe we're going to be able to close that within  
12 just the next few months. The issue resolution status  
13 report on that is due out the end of November. It's a  
14 little bit of additional work that we want to finish up to  
15 be confident that we have no further questions at this  
16 point.

17 Development of a model for shallow infiltration is  
18 continued through this year, another area that is  
19 potentially quite important to performance. In fact, it  
20 comes up in the top of the list for almost everyone's  
21 performance assessment, because shallow infiltration in turn  
22 drives the deep percolation through the repository level,  
23 and down to the saturated zone. Interestingly, we're  
24 finding considerably higher estimates than were originally  
25 conceived, and that is an important finding from the

1 standpoint of our modeling, and we're beginning to see  
2 confirmation from the results of DOE's testing in that  
3 particular area.

4 I note here and I mention it because of a question  
5 you had raised earlier, Chairman, with regard to the  
6 sorption area. We have completed some work in that area,  
7 and have translated or transferred a critical portion of the  
8 sorption studies into the performance assessment area, so  
9 that what we learned experimentally before the research  
10 program was consolidated and the activities at the Center  
11 under sorption were reduced, we've been able to capture that  
12 information and develop a module which will be incorporated  
13 in the total system performance assessment code. So we will  
14 be able to consider the kind of phenomena that I mention  
15 here, importance of pH variations, for instance.

16 And again, just the last bullet, we've touched on  
17 that a couple of times with regard to their flexibility in  
18 bringing in additional studies.

19 Now the second bullet on this chart 18, I'd like  
20 to address a little bit further with the figure that is  
21 shown on chart 19.

22 COMMISSIONER ROGERS: Before you go to the next  
23 one --

24 MR. PATRICK: Certainly.

25 COMMISSIONER ROGERS: How do the third and fifth

1 bullets relate to each other, the chlorine-36 measurements  
2 that come from fracture flow presumably and your shallow  
3 infiltration models?

4 MR. PATRICK: We have not --

5 COMMISSIONER ROGERS: How do they relate to each  
6 other? Are they totally disconnected?

7 MR. PATRICK: No, they're not disconnected at all.  
8 In fact, I would say that from chlorine-36 information gives  
9 very keen insights and confirmation of what the shallow  
10 infiltration studies show, namely that infiltration is not  
11 homogeneous across the mountain. No one expected it to be  
12 purely homogeneous, but we're finding that there are  
13 combinations of surface cover, vegetation, and so forth  
14 which seem to -- as well as fracturing, of course -- which  
15 seem to enhance the infiltration.

16 What the chlorine-36 is saying is not only is  
17 there enhanced infiltration in those areas, but that  
18 enhancement continues to depth. The moisture is not sucked  
19 back into the matrix, at least in some locations where the  
20 chlorine-36 information indicates rather short groundwater  
21 travel times. So they're very, very closely related to one  
22 another, and we're considering them in that integrated  
23 fashion.

24 If we could take a look at the figure then on  
25 slide 19.

1           A and C gives you a picture of a sandbox model, an  
2 inglorious name that is used for a very sophisticated  
3 physical analog technique. I believe the Chairman and  
4 Commissioner Rogers may have had an opportunity to see that  
5 on their visits at the center in the past. I don't recall  
6 whether it was up and running at the time.

7           CHAIRMAN JACKSON: I saw it.

8           MR. PATRICK: But it was through that type of  
9 modeling work as well as what has been learned in the  
10 trenches through DOE and its contractor studies that we were  
11 able to sit as a group in an Appendix 7 meeting in a very  
12 open forum and discuss as professionals the variety of  
13 models, more than a dozen, that were on the table at that  
14 time and talk about an efficiency factor that Margaret  
15 Federline was mentioning earlier.

16           We were able to zero in on less than half of those  
17 models, four or five depending on the way you want to count  
18 them, that seemed to be most supportable given the wide  
19 variety of data that is available from the site as well as  
20 these confirmatory kinds of studies with the sandbox models,  
21 which give us insights into how these processes play out  
22 over time.

23           You can see -- there are a variety of little  
24 symbols on there I don't have time to go into in detail, but  
25 you'll note that we find, for instance that there are -- the

1 BF stands for -- there are boundary faults which align the  
2 edges of the basin and they can be controlling factors in  
3 the dominant seismic risk that exists at the site.

4 There are faults which develop at some point in  
5 the development of the basin but become inactive as time  
6 goes on. That's very important to know from a design  
7 perspective as well as from a performance assessment  
8 perspective in the very long term.

9 This kind of physical modeling has been very, very  
10 helpful in leading us closer to issue resolution, and we  
11 anticipate publishing an issue resolution status report in  
12 this area as well in the next year.

13 Slide 20, please.

14 Moving to the engineering area from site  
15 characterization as part of the closeout activities in the  
16 area of container life and source term, we have taken the  
17 repassivation potential model that was developed under the  
18 experimental research program and worked within the  
19 licensing program a little bit later on, and we've  
20 incorporated that into the total system performance  
21 assessment code. We're trying to, in these areas where  
22 there have been restrictions, to harvest what was able to be  
23 learned in those early years, and I think we're being quite  
24 successful in doing so.

25 Another design related area where we encountered a



1 little bit of a good news/bad news situation is in the third  
2 bullet there. We did some benchmarking this year. We  
3 wanted to understand whether there were any areas of  
4 disagreement between the NRC and the DOE staffs regarding  
5 the kinds of computer codes they were using.

6 The good news part is that we found we had very  
7 good agreement as we went through that benchmarking study.  
8 The bad news part is that there has been some laboratory  
9 work and field studies done that indicate that those  
10 equivalent continuum models, as they're called, may not be  
11 adequate for capturing some of the details, details, for  
12 instance, like nearby dripping from single fracture such as  
13 what we see documented in the Chlorine 36 data.

14 So that's an area where we believe some additional  
15 work is going to be needed before we can close that  
16 particular issue.

17 As I've noted before, we're seeing some  
18 improvements evident in the DOE design control process, and  
19 it appears at this time that their design control process is  
20 adequate. We'll be continuing to monitor that. We in this  
21 case will be Mike Bell's staff. The center has no longer  
22 any tasking in this particular area. So they will be  
23 monitoring that with in-house engineering staff.

24 The staff continues to evaluate DOE's testing  
25 program as well. The thermohydrology testing area is one

1 that has caused concerns in the past. We again have had  
2 open dialogue in this area, and it's my understanding that  
3 rather shortly, DOE will be replying to a particular set of  
4 comments that we sent out with regard to the degree of  
5 heating, the spacial scales of their testing and so forth,  
6 which could be important from the standpoint of  
7 understanding the processes that are taking place. Those  
8 processes in turn have to be accurately reflected in the  
9 performance assessment models so that we can be confident of  
10 the results of those determinations.

11 I would like to touch on that second bullet on  
12 slide 20 as we look at the figure on slide 21.

13 DOE noted in their most recent TSPA a possibility  
14 that galvanic coupling could occur between their complex  
15 waste packages, waste package configuration where there are  
16 different metals and roughly concentric cylinders around one  
17 another.

18 We factored that into our calculations and did a  
19 study, the results of which are indicated here, and a key  
20 point, if we were just to look at, for instance, the blue  
21 curve there, you'll notice that at a low -- well, that's  
22 actually DOE's moderate thermal loading strategy, around 40  
23 metric tons uranium per acre, that you would predict a waste  
24 package lifetime on the scale of tens of years for low  
25 galvanic efficiencies. But if this galvanic coupling

1 efficiency factor has a value something about .08 or so, you  
2 get a dramatic increase in the performance of the entire  
3 waste package because that outer container acts as a  
4 sacrificial anode protecting that inner container.

5 We wanted to be sure that that phenomenon  
6 continued at other thermal loads and I've indicated here for  
7 an 80 metric ton uranium per acre case, you would see an  
8 improvement in waste package performance from on the order  
9 of 2,000, 2,500 years again jumping up to something in  
10 excess of 10,000 years based on these calculations.

11 Now, the big question is, what is the real  
12 galvanic coupling efficiency factor? And some work is going  
13 to be needed there, both from our standpoint and also from  
14 the Department of Energy's standpoint. We envision that  
15 some additional calculations to examine how sensitive  
16 performance is to this factor will be taking place as we  
17 complete the TPA code and do this --

18 CHAIRMAN JACKSON: That's material dependent also?

19 MR. PATRICK: Very much so. So the ultimate  
20 design in the selection of materials is going to be very  
21 important. As I think you're aware, there are many  
22 materials in the mix right now, both for the outer overpack  
23 and the inner overpack.

24 The other factor that is critical is whether water  
25 comes into contact in the interface, because if there is not

1 an electrolyte between those two materials, this factor is  
2 zero, and there's nothing to be gained.

3 Slide 22.

4 A third area I would like to speak briefly to is  
5 the total system performance assessment program. One of the  
6 early contributions to the program in the total system area  
7 was development of timely guidance to the Department of  
8 Energy in the area of expert elicitation.

9 Because DOE is relying quite heavily on expert  
10 elicitations, we're interacting with them to ensure  
11 ourselves that that Branch Technical Position that was  
12 issued by the staff is being implemented in a manner that is  
13 consistent with NRC's guidance, not only to be confident  
14 that the process is working, but also that the product that  
15 that process results in is also working well.

16 CHAIRMAN JACKSON: May I ask you a question back  
17 on slide 21 for a second? You know, given what you just  
18 said about the galvanic coupling, and you need a galvanic  
19 coupling efficiency that apparently, you know, is larger and  
20 larger as the thermal load increases --

21 MR. PATRICK: Yes.

22 CHAIRMAN JACKSON: -- is there not a question  
23 having to do with the likelihood of achieving that thermal  
24 coupling as a function of thermal load?

25 MR. PATRICK: There can be. I believe that the

1 answer to the question is found in a combination of when you  
2 need it, if it is hot enough, there is no water there.

3 CHAIRMAN JACKSON: That's right.

4 MR. PATRICK: So galvanic coupling neither works,  
5 nor is needed.

6 CHAIRMAN JACKSON: Nor is needed. Okay.

7 MR. PATRICK: So for a hot enough repository, this  
8 issue will have zero sensitivity. And by the way, you've  
9 hit on a very interesting aspect of all of these sensitivity  
10 studies, is that you base your determination of sensitivity  
11 at any given point on a particular understanding. As that  
12 understanding changes, it gets wetter in the repository, it  
13 stays hotter and dryer longer, then you have to revisit  
14 those things. That's very important.

15 Anything else on that one?

16 Coming back, then, following on from the Branch  
17 Technical Position, moving into the core of the TSPA  
18 program, the Department of Energy submitted total system  
19 performance assessment '95, TSPA '95. We conducted both  
20 audit and detailed reviews of that TSPA and provided timely  
21 comments to DOE, and we're involved in a technical exchange  
22 with them to sit eyeball-to-eyeball and hear one another out  
23 on those issues.

24 We raised what we feel are a number of important  
25 concerns in areas such as lack of conservatism and

1 infiltration. I touched on that earlier. We're now  
2 beginning to see a coming together of our thinking there at  
3 a higher infiltration level. The role of dilution, waste  
4 package failure models and so forth.

5 We're currently examining DOE's TSPA viability  
6 assessment plan, and it appears that a number of our  
7 comments have been taken into consideration there. Of  
8 course, we're quite pleased to see that, and our view --  
9 you'll hear from DOE tomorrow, but our view is that that's  
10 been a significant positive contribution, both in moving us  
11 toward issue resolution and also moving the program forward  
12 to decision points.

13 I have noted previously the modifications to the  
14 total system performance assessment code, enhancing the  
15 process models, revising it to handle DOE's planned drift  
16 emplacement and improving the computational efficiency.  
17 We've also modified it to include the anticipated dose and  
18 risk based performance measures. Those were not present in  
19 TPA 2, which was, under the old standard, was a release  
20 based assessment of performance.

21 I've noted that a key thing that has been done is  
22 this code is now available to a much broader cross section  
23 of staff, both at the center and at the NRC, and I think  
24 that's very important to develop that broad user group from  
25 an efficiency point of view and also strictly from the

1 standpoint of the volume of analysis that we're able to  
2 complete within the time that's available.

3 My observations to this point apply predominantly  
4 with regard to how we have influenced DOE's program using  
5 this total system code and the total system approach, but I  
6 think equally important are the impacts that we've seen  
7 internally, and we've touched on those, alluded to those a  
8 little bit before. It has helped us greatly to align our  
9 key technical issues to DOE's waste containment and  
10 isolation strategy.

11 To your earlier question, Commissioner Rogers,  
12 they are not exactly the same, but we have an explicit  
13 correlation between the two, and as issue resolution status  
14 reports are published, each one of those will explicitly  
15 identify which items within DOE's waste containment and  
16 isolation strategy are being addressed by that particular  
17 key issue resolution status report.

18 So that kind of close coupling I think is very  
19 important. It's assisting us and we think it's going to  
20 assist DOE as well. It has helped us focus our plans on  
21 these issue resolution and also on the inputs that are  
22 needed to the total system performance assessment code,  
23 enabling us to develop a consistent set of data for those  
24 analyses and, of course, has led to increased integration  
25 and broad participation. Conducting team training goes hand

1 in glove with the staffs working together in this total  
2 system performance assessment area.

3 The final, the fourth area I would like to touch  
4 on deals with NRC staff interactions with the EPA regarding  
5 the development of a Yucca Mountain specific standard and  
6 the support that the center has provided to aid NRC staff in  
7 progressing in that area.

8 There will be a NUREG document which will be  
9 published shortly that contains the results of the  
10 supporting calculations that have been done. Three  
11 particular areas here that we have addressed are noted. We  
12 have evaluated the relative radiological hazard of a  
13 repository as time goes on. That has given us insights into  
14 what a reasonable period of compliance might be. That was  
15 an area that was questioned.

16 We have used core body equivalent types of  
17 analyses to examine that. We've also examined how peak dose  
18 is location specific, something that the Academy did not  
19 specifically address but which ends up being quite important  
20 if one chooses to go to a peak dose determination or  
21 standard. And then, of course, NRC policy and public  
22 comments are going to need to be considered in this process.

23 We calculated following the NAS recommendation a  
24 stylized human intrusion scenario and found that both the  
25 consequences and the probability of inadvertent human



1 intrusion were relatively low for a Yucca Mountain type  
2 repository design. Finally, we've looked at the relative  
3 importance of disruptive events and, not too surprisingly,  
4 although it seems to surprise some, as the time period of  
5 performance gets longer, those take on an ever-increasing  
6 role.

7 CHAIRMAN JACKSON: Repeat what you said about the  
8 calculated effects of human intrusion.

9 MR. PATRICK: Based on our calculations, the  
10 probability and the consequences of inadvertent human  
11 intrusion are relatively low, quite a different conclusion  
12 with regard to probability than, for instance, WIPP would  
13 decide, and that has a lot to do with the relative area  
14 containing waste with regard to the total target area that a  
15 driller could intersect.

16 CHAIRMAN JACKSON: I see.

17 COMMISSIONER ROGERS: The next bullet after that,  
18 the relative importance question, is that just simply that  
19 the longer you wait, the more events you're going to have or  
20 --

21 MR. PATRICK: Exactly.

22 COMMISSIONER ROGERS: -- or is there anything more  
23 --

24 MR. PATRICK: No. It's, again, it's intuitively  
25 obvious once it's brought to one's attention, I guess.

1 The interaction --

2 CHAIRMAN JACKSON: That's what intuitively obvious  
3 means, right?

4 [Laughter.]

5 MR. PATRICK: Intuitively obvious, but you have to  
6 prove them often.

7 The interaction between EPA and NRC regarding the  
8 NAS recommendations -- NRC staff has been in frequent  
9 contact, up until just a few months ago, with EPA. I think  
10 the general assessment there is that we have general  
11 agreement on the approaches that they are suggesting, things  
12 like the 10,000 years being a reasonable time period for a  
13 standard, using an individual dose, stylized treatment of  
14 human intrusion, definition of the critical group and so  
15 forth, but there are a few critical issues, two in  
16 particular, and we've mentioned those already and I'm sure  
17 those will continue to be points of discussion.

18 The final item, one that we've touched on just  
19 briefly, is we have begun examining options for a risk-  
20 informed performance-based regulation, and staff will be  
21 coming forward to you with a Commission paper in that  
22 particular area, and we anticipate supporting those  
23 activities.

24 COMMISSIONER DIAZ: Is that going to happen this  
25 year or do you know what's the time table for that

1 performance-based rule -- you know, when?

2 MS. FEDERLINE: We will be getting up to the  
3 Commission in early fall with an options paper, and assuming  
4 you provide us guidance, we would intend to begin at that  
5 point.

6 MR. PATRICK: If there are no further questions  
7 for me, I'll turn the floor back over to Margaret Federline.

8 MS. FEDERLINE: Yes. I just wanted to emphasize  
9 three points in summary on slide 24.

10 We feel that feedback and interactions with DOE  
11 have resulted in significant progress, even at reduced  
12 budget levels for both agencies. We've demonstrated that  
13 focused interactions can result in agreements and improved  
14 understanding of differences, and we believe that this is  
15 going to be key to making reasonable national decisions  
16 about a waste repository.

17 I would also like to emphasize that enhancement of  
18 both the NRC's and the Center's total system performance  
19 capability have been fundamental in achieving this progress.  
20 The experience that the staff has gained in being able to  
21 focus on a system's perspective rather than a disciplinary  
22 view is key to determining when enough is enough in terms of  
23 data and when bonding is sufficient.

24 The final -- I would also like to emphasize that  
25 maintaining the infrastructure is key here. In order to do

1 the calculations, we need to maintain the equipment and  
2 software that enables us to do those calculations.

3 Finally, I just wanted to note that future funding  
4 is uncertain and we believe that keeping pace a national  
5 program depends upon obtaining funding at higher levels.

6 CHAIRMAN JACKSON: Thank you.

7 Commissioner Rogers?

8 COMMISSIONER ROGERS: Well, just on that last  
9 slide, our total system performance assessment capability,  
10 have we slipped in that?

11 MS. FEDERLINE: No. I think we have made  
12 significant improvements in that area. We have -- between  
13 phase 2 and phase 3, we've added some significant additional  
14 conceptual models allowing us to look at two conceptual  
15 models in the thermohydrology area. So there really are  
16 some significant enhancements in terms of being able to look  
17 at repository performance.

18 There are also significant enhancements in the  
19 simplicity of the code and the ability for multiple people  
20 to use and benefit from the code.

21 COMMISSIONER ROGERS: Well, the capability  
22 involves not only the codes and the hardware, but also  
23 people.

24 MS. FEDERLINE: That's correct.

25 COMMISSIONER ROGERS: Have we been able to

1 maintain our staffing level there?

2 MS. FEDERLINE: Well, I think it's fair to say  
3 that the staffing level has been reduced, but we feel we're  
4 spreading the experience within the staff that we do have.  
5 So I think there is more of a focus that performance  
6 assessment is all of us, it's not one unique aspect.

7 COMMISSIONER ROGERS: That's all I have.

8 CHAIRMAN JACKSON: Commissioner Dicus?

9 COMMISSIONER DICUS: No, no questions. Just thank  
10 you for your presentations.

11 CHAIRMAN JACKSON: Commissioner Diaz?

12 COMMISSIONER DIAZ: I would just comment on the  
13 idea of funding and the issue of closure. You know, this  
14 program is completely starved for providing closure on a  
15 series of issues, and it might very well be that closing  
16 some of those as early as possible would be a very, very  
17 good impetus to the program.

18 CHAIRMAN JACKSON: Commissioner McGaffigan?

19 COMMISSIONER MCGAFFIGAN: I would like to raise  
20 one question that's slightly off the subject, but there was  
21 a separate large computer effort relating to public  
22 involvement when we got to the licensing stage, and I forget  
23 the --

24 MR. PATRICK: LSS.

25 COMMISSIONER MCGAFFIGAN: The LSS, the licensing

1 support system. Thank you.

2 My judgment when I first looked at that was that  
3 you had already reviewed it, it was gone, but it was one of  
4 these systems which was going to be typical of the federal  
5 information system, was going to be obsolete before arrival.

6 You're now looking at something different. That's  
7 a different group of people that are doing that? And how is  
8 that budgeted? Is that budgeted within the DOE high level  
9 waste budget and they basically, you know, have to design  
10 the system to whatever standard we ultimately give them?

11 MS. FEDERLINE: DOE is responsible for the  
12 operation of the system, but we must budget to -- audit to  
13 ensure that the documents and to certify -- I believe in  
14 part 2, there is a certification role for NRC to assure that  
15 the documents have been properly entered.

16 COMMISSIONER McGAFFIGAN: And so that's a future  
17 budgetary issue for us. And relatively small or --

18 MS. FEDERLINE: Let me ask John --

19 MR. GREEVES: John Greeves.

20 MS. FEDERLINE: John Greeves is the steering  
21 committee member.

22 MR. GREEVES: We participate with IRM on this  
23 issue and I think if you look at our current budget, you'll  
24 see it's running something like 1 FTE and 100K for the next  
25 few years.

1           There's always this debate about when is LSS going  
2 to really happen, and what's been going on in LSS territory  
3 is all the groups have recognized that an Internet-based  
4 approach is on top of us now. There is no point in going  
5 with this old approach that will be this megasystem that  
6 will cost a bunch of dollars and is housed by DOE solely.  
7 So we've talked with all the parties about an Internet-  
8 based approach and it's been running on what I call a small  
9 budget.

10           So I think the crunch on this is going to come and  
11 I believe IRM put numbers in '99 where it just depends on  
12 what happens to part 2. Are we going to switch to an  
13 Internet-based approach where each party, like NRC, puts all  
14 of our documents up on the computer, makes them available on  
15 the Internet -- by the way, we have that capability now; we  
16 have a test case that exists -- and whether all the other  
17 parties would do the same thing. It would be obviously much  
18 more cost effective to do it that way.

19           I think the knotty question is what will IRM have  
20 to do in terms of auditing something like that and I think  
21 out to about '99, it's not a big budgetary issue, but the  
22 last number I looked at does become significant in '99 if  
23 IRM has to do this audit process in terms of hiring a bunch  
24 of people or a contractor to do it.

25           So I think it's probably worth your time to talk

1 to us separately on that topic, but right now, it's pretty  
2 much a level of effort and we're working with OGC on looking  
3 into how this would be accomplished with part 2.

4 CHAIRMAN JACKSON: Okay. Thank you.

5 I have one last question for Dr. Patrick.

6 Are there any of the activities in which you've  
7 been engaged or are currently engaged that have any  
8 potential fungibility in terms of being applicable to an  
9 interim storage facility?

10 MR. PATRICK: I believe so, particularly in the  
11 engineering area, both in material sciences and also in the  
12 staff that has supported what we call the repository design,  
13 construction and operations group.

14 In fact, interestingly, those who crafted the  
15 original request for proposal for establishing the center  
16 included monitored retrievable storage under the repository  
17 area. So skills and civil engineering and structural  
18 engineering, material sciences, corrosion issues and things  
19 of that nature, as well as seismic risk and the like, those  
20 are areas where I think there's quite good fungibility.  
21 That is a relatively small percentage of our total staff,  
22 but those skills are available.

23 CHAIRMAN JACKSON: Okay. Thank you.

24 Well, the Commission would like to thank you, Dr.  
25 Patrick, and the NRC staff for a very informative briefing.



1 The information you presented us provides us with a  
2 perspective on where we are and the challenges the NRC's  
3 program faces and the Commission commends you and commends  
4 you and the Center for working through these issues in very  
5 difficult circumstances, yet developing and maintaining a  
6 credible program, and needless to say, what you've presented  
7 will be useful in our future considerations.

8 I just want to make a comment. If you flip back  
9 to your viewgraph 5 and we look at the -- you know, the DOE  
10 budget has been itself buffeted, but if we look at the NRC  
11 and DOE repository funding levels and if we look at where we  
12 were in FY '95 relative to our request, or even where we  
13 were in FY '97 where we used 3 million carryover, that the  
14 DOE budget had gone below the dip it had earlier by a factor  
15 of about 15 percent, and a 15 percent, if we were assuming  
16 the same kind of a scaling, from our funding level would  
17 have put us at 18.7 million in appropriated funds from the  
18 Nuclear Waste Fund.

19 The point I'm making is that I think we all know  
20 and it gives me the opportunity for the public record to say  
21 that the issue of our keeping pace with the national high  
22 level waste program at a level commensurate with the  
23 responsibilities that we have and with additional  
24 responsibilities that we may be asked to have is a very,  
25 very serious issue.

1           It is one that I, in fact, did speak to at the  
2 congressional hearing on the high level waste bill pending  
3 in the House. It is one that you should know that the  
4 Commission has not lost sight of, will not lose sight of  
5 and, you know, we intend to fight this issue, because there  
6 is no way we can do what we are asked to do in the law if we  
7 don't have the money to do it. That kind of simplified  
8 comparison shows the level of difficulty that we have.

9           So the Commission requests that you keep us  
10 informed, you know, of the progress and we'll have to stay  
11 on top of it. We look forward to hearing from both the  
12 staff and the Center on this important issue.

13           We're adjourned.

14           [Whereupon, at 2:59 p.m., the briefing 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: BRIEFING ON STATUS OF ACTIVITIES WITH  
CNWRA AND HLW - PUBLIC MEETING

PLACE OF MEETING: Rockville, Maryland

DATE OF MEETING: Wednesday, May 14, 1997

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: John Ulmer

Reporter: Jon Hundley



# **NRC HIGH-LEVEL WASTE REPOSITORY PROGRAM HIGHLIGHTS AND ACCOMPLISHMENTS**

**Presented by**

**Margaret V. Federline  
Wesley C. Patrick**

**May 14, 1997**

## **OUTLINE OF BRIEFING**

- **Factors influencing the NRC HLW repository program.**
- **Overview of refocused program.**
- **Progress in meeting program objectives.**
- **Conclusions.**

# **FACTORS INFLUENCING THE NRC-HLW REPOSITORY PROGRAM**

## **KEY ASSUMPTIONS FOR FY 1997 PROGRAM**

- **Statutory requirements remain until pending legislation is passed.**
- **EPA standard will be proposed in 1997 and finalized in 1998.**
- **DOE will continue to implement its Revised Program.**
- **Future budgets are highly uncertain.**

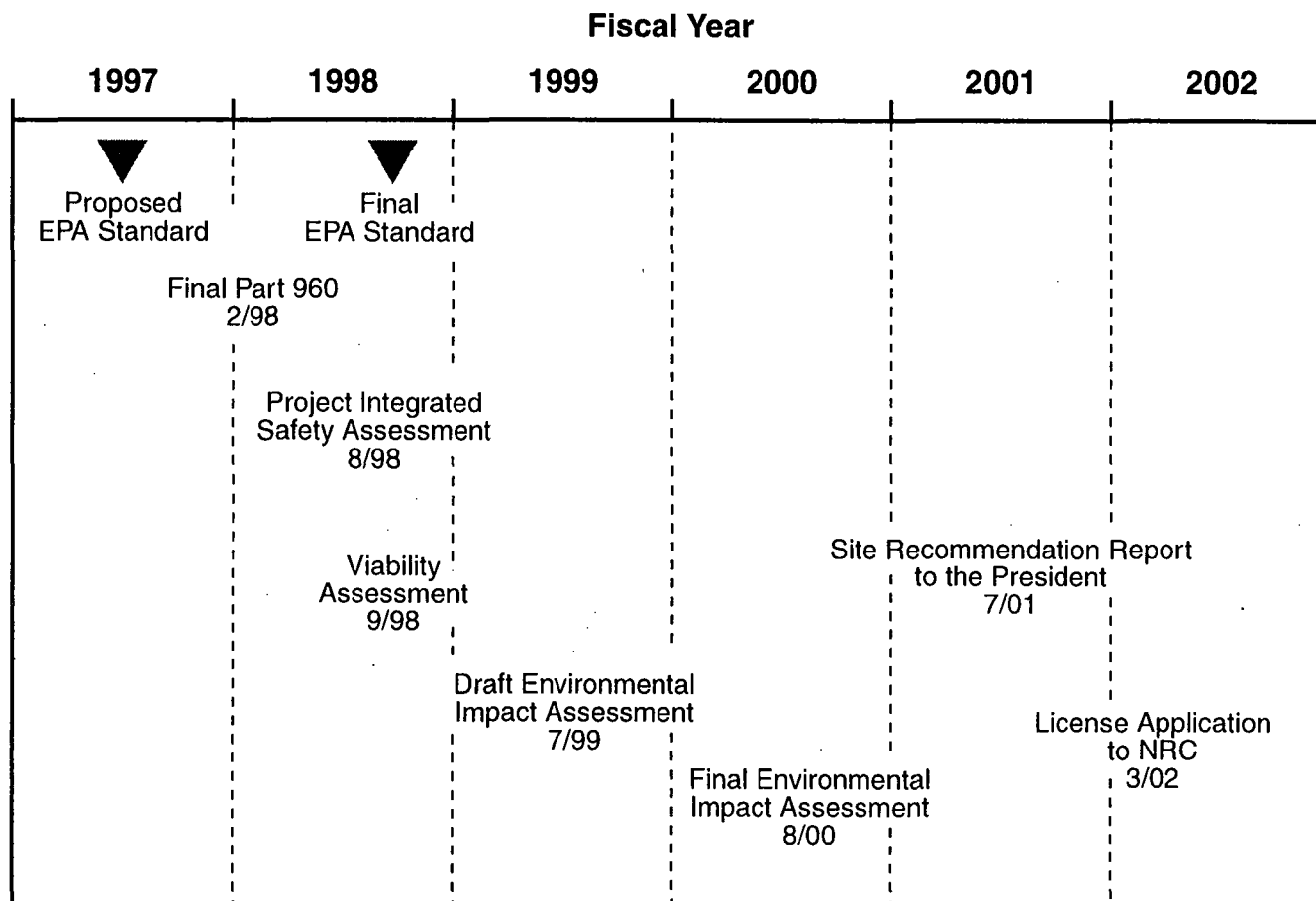
# **NRC AND DOE REPOSITORY FUNDING LEVELS**

	<u><b>NRC HLW PROGRAM</b></u>	<u><b>DOE YUCCA MT.*</b></u>
<b>FY 1995</b>	<b>\$22M</b>	<b>\$375M</b>
<b>FY 1996</b>	<b>\$17M (\$11M NEW + \$6M CARRYOVER)</b>	<b>\$250M</b>
<b>FY 1997</b>	<b>\$14M (\$11M NEW + \$3M CARRYOVER)</b>	<b>\$325M</b>
<b>FY 1998 REQUEST</b>	<b>\$17M (NO CARRYOVER)</b>	<b>\$325M</b>

**\* DOE briefing to NRC (April 1997)**



# KEY DOE PROGRAM MILESTONES



# **OVERVIEW OF REFOCUSED NRC PROGRAM**

# **NEAR-TERM PROGRAM OBJECTIVES**

- **Cooperate with EPA in developing a practical and implementable safety standard.**
- **Implement HLW standards by developing a risk-informed performance-based rule specific to Yucca Mountain.**
- **Set program priorities on key technical issues that are most important to repository performance.**
- **Resolve key technical issues at the staff level prior to viability assessment and provide feedback to DOE.**
- **Review elements of DOE's viability assessment and prepare to answer questions concerning potential licensing vulnerabilities.**
- **Continue to improve program efficiency including focusing interactions with DOE and other parties.**

# **PROGRAM STRATEGY**

- **Continue present strategy through the viability assessment review in FY 1999.**
- **In FY 1997, focus on resolving 7 key technical issues prior to viability assessment.**
- **Monitor DOE's program for 3 issues where CNWRA support was eliminated by the FY 1997 budget reduction.**
- **Feedback to DOE provided by:**
  - **Annual Progress Reports covering all key technical issues.**
  - **Issue Resolution Status Reports including acceptance criteria.**
  - **NRC-DOE interactions to reach agreements or document differences and action plans for resolution.**
- **FY 1998 budget request for \$ 17 million would support present strategy for all 10 key technical issues.**

# **FUTURE SHIFT IN PROGRAM STRATEGY**

- **Recommend shift to a “comprehensive” approach after viability assessment review necessary to prepare for the following statutory actions.**
  - **Comments on sufficiency of at depth site characterization and waste form proposal**
  - **Review and adopt DOE’s Environmental Impact Statement**
  - **License application review**
- **Preparations include independent performance assessments and necessary follow-up on new information regarding key technical issues.**
- **Preparations include activities deferred by budget reductions such as development of a Standard Review Plan including preclosure and postclosure issues.**
- **Increased focus on quality assurance activities.**
- **A “comprehensive” approach depends on increased funding.**

# **CONSOLIDATION OF HLW RESEARCH ACTIVITIES**

- **In FY96, HLW research was consolidated into NMSS technical assistance principally for the following key technical issues:**
  - **Saturated/unsaturated flow**
  - **Igneous activity**
  - **Near field environment**
  - **Container life and source term**
  - **Radionuclide transport**
- **RES initiated a generic waste management research program focusing on source term, engineered barriers, transport mechanisms, dose pathways, and performance assessment.**

# **CONTINUING INTERACTIONS AND INITIATIVES WITH RES**

- **NMSS and RES efforts continuing to ensure exchange of information.**
- **Resource constraints place practical limitations on extent of interactions.**
- **RES does monitor HLW activities.**
- **NMSS provides copies of regulatory products and Center reports.**
- **NMSS staff participate in RES workshops and program reviews.**
- **NMSS and RES plan a annual meeting dedicated to the exchange generic technical information.**
- **Areas of mutual interest include dose pathways, environmental transport, and source term.**

# **PROGRESS IN MEETING PROGRAM OBJECTIVES**



## **ANNUAL PROGRESS REPORT FOR FY 1996 (NUREG/CR-6513)**

- **Defines NRC key technical issues and links them to DOE Waste Containment and Isolation Strategy.**
- **Documents the path to resolution and progress for each of the 10 key technical issues.**
- **Consolidates and integrates feedback to DOE.**
- **Facilitates dialog with DOE.**

# **OVERVIEW OF PROGRESS AND PLANS**

- **Established sound technical basis in FY 1996 for resolution of technical issues in FY 1997.**
- **Improved understanding of processes critical to repository performance through review of existing data and collection of new data.**
- **Enhanced or completed models representing processes important to repository performance.**
- **Conducting sensitivity analyses of individual repository systems or processes to focus issue resolution.**
- **Progressed toward resolution of three key technical issues with DOE.**
- **Updated total system performance assessment code to enhance process models, treat revised designs, and improve computational efficiency.**
- **Updated systems code to conduct integrated sensitivity analyses of total system.**

# **OVERVIEW OF PROGRESS AND PLANS**

## **(Continued)**

- **Use results of total system analyses as decision-aiding tools:**
  - **Reevaluate importance of key technical issues**
  - **Develop risk-informed, performance-based acceptance criteria**
  - **Prepare methods for review of viability assessment**
- **Develop Issue Resolution Status Reports including acceptance criteria.**
- **Provide staff insights on resolving key technical issues in the FY 1997 Annual Progress Report.**

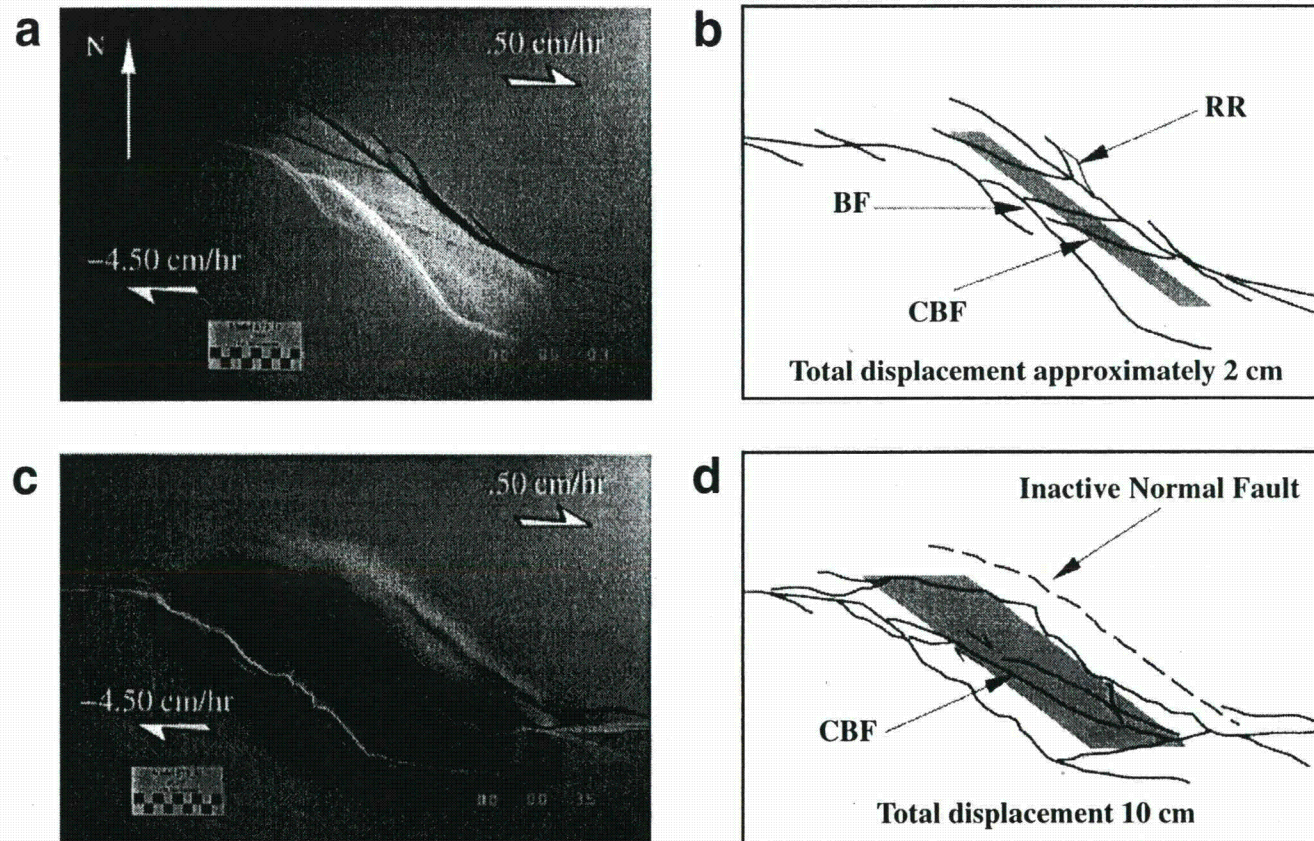
# **GENERAL VIEWS ON THE DOE PROGRAM**

- **Clear improvement in DOE's overall program management and planning processes.**
- **Communication with NRC has continued to improve with interactions focused on reaching agreements on issues at the staff level.**
- **Focus and integration of program much improved by using total system performance assessments and Waste Containment and Isolation Strategy.**
- **Completion of main Exploratory Studies Facility tunnel and continuation of associated testing.**
- **Documentation of safety-related design, operations, characterization and strategic decisions needs to improve.**
- **Continued attention to quality assurance implementation necessary.**

## **HIGHLIGHTS OF NRC PROGRESS AND VIEWS ON DOE'S SITE CHARACTERIZATION PROGRAM**

- **Reached agreement that the annual probability of volcanism is low; identified factors that will be the focus of consequence analyses.**
- **Focused future geologic investigations by narrowing range of tectonic models and identifying faults most likely to affect performance.**
- **Developed model for shallow infiltration and obtained initial bound on deep percolation that checks with DOE data.**
- **Identified that Np and U sorption is highly sensitive to pH variations; can vary by orders of magnitude.**
- **Evaluated extent of fracture flow using DOE CI-36 measurements.**
- **View positively DOE giving additional emphasis to hydrologic testing of the saturated zone.**

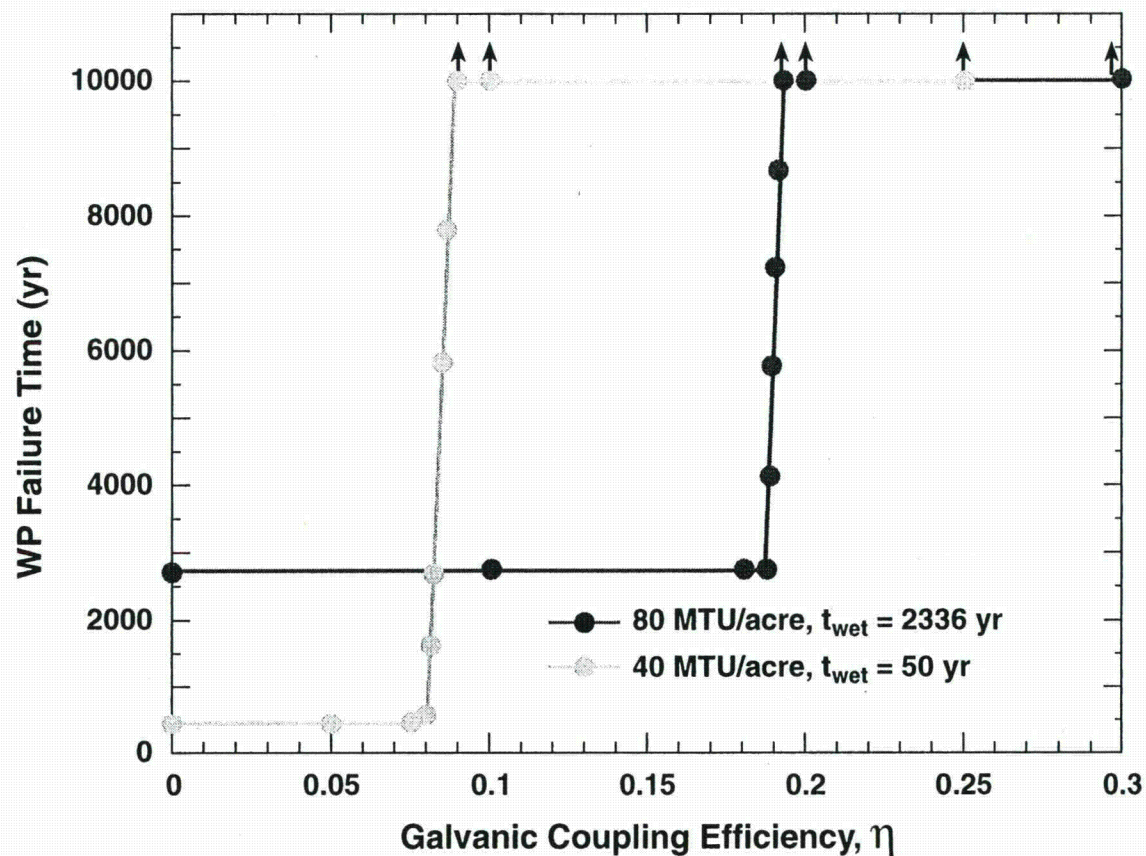
## PHYSICAL MODEL RESULTS SHOWING RELATIONSHIPS AMONG FAULTS NEAR YUCCA MOUNTAIN



## **HIGHLIGHTS OF NRC PROGRESS AND VIEWS ON DOE'S EXPLORATORY STUDIES FACILITY, REPOSITORY, AND WASTE PACKAGE DESIGN PROGRAM**

- **Incorporated methodology to bound localized corrosion rate in total system performance assessment code.**
- **Identified that galvanic coupling can significantly increase waste package life; limited testing and modeling required to determine the effectiveness of coupling.**
- **Determined that equivalent continuum models are inadequate for simulating fracture flow; benchmarking demonstrated that DOE and NRC thermohydrology codes produce similar results.**
- **Concluded DOE design control process is adequate; monitor implementation.**
- **Nearing agreement on DOE seismic design methodology.**
- **Agreed with DOE's phased approach to thermohydrology testing but raised concerns about representativeness of thermal load.**

# EFFECT OF GALVANIC COUPLING ON WASTE PACKAGE FAILURE TIME





## **HIGHLIGHTS OF NRC PROGRESS AND VIEWS ON DOE'S TOTAL SYSTEM PERFORMANCE ASSESSMENT PROGRAM**

- **Provided DOE timely guidance on expert elicitation with Branch Technical Position (NUREG-1563); DOE is implementing.**
- **Reviewed DOE TSPA-95 and provided timely comments on areas of agreement, conservativeness, and documentation requirements.**
- **Included revised DOE designs, anticipated changes to EPA standard, and enhanced process models in total system performance assessment (TPA) code.**
- **Enhanced integration and effectiveness of NRC/CNWRA team.**
  - **Aligned key technical issues with hypotheses of DOE's Waste Containment and Isolation Strategy**
  - **Focused plans on issue resolution and inputs needed for TPA code**
  - **Developing the TPA code with broad participation from all disciplines**
  - **Evaluating team effectiveness and conducting team training**
  - **Implemented TPA code on the SUN Workstation Platforms of the NMSS Advanced Computer System**

## **HIGHLIGHTS OF NRC PROGRESS AND INTERACTIONS REGARDING THE EPA STANDARD AND NRC RULE**

- **Completed scoping calculations for interactions with EPA on critical components of the standard (NUREG-1538).**
  - **Evaluated relative radiological hazard to assess time frames for compliance**
  - **Calculated effects of human intrusion**
  - **Determined that relative importance of disruptive events increases with compliance period**
- **Interacted with EPA on NAS recommendations and EPA's proposed standard.**
  - **General acceptance on appropriate approaches in many areas**
  - **Significant differences remaining for groundwater protection and level of protection**
- **Developing options for a performance-based rule specific to Yucca Mountain.**

# CONCLUSIONS

- **Feedback and interactions with DOE resulted in significant progress toward issue resolution.**
  - **Demonstrated that focused interactions can result in agreements and improved understanding of differences and how to resolve them**
  - **Made progress on difficult issues that are critical to the program including igneous activity, total system performance assessment, and thermal hydrological testing**
- **Enhancement of NRC's total system performance assessment capability and integration needed to:**
  - **Evaluate what issues are important to repository performance**
  - **Resolve issues (e.g., sufficiency of data and acceptability of bounding assumptions)**
  - **Determine compliance with revised EPA standard**
- **Future funding is uncertain; keeping pace with the National program depends on obtaining increased funding at a level commensurate with NRC HLW responsibilities.**