

Official Transcript of Proceedings

ACNWT-0154

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Nuclear Waste  
133rd Meeting

Docket Number: (not applicable)

ORIGINAL

Location: Rockville, Maryland

PROCESS USING ADAMS  
TEMPLATE: ACRS/ACNW-005

Date: Thursday, March 21, 2002

Work Order No.: NRC-283

Pages 185-321

NEAL R. GROSS AND CO., INC.  
Court Reporters and Transcribers  
1323 Rhode Island Avenue, N.W.  
Washington, D.C. 20005  
(202) 234-4433

TRO8

ACNW OFFICE COPY - RETAIN FOR  
THE LIFE OF THE COMMITTEE

1 UNITED STATES OF AMERICA

2 NUCLEAR REGULATORY COMMISSION

3 + + + + +

4 ADVISORY COMMITTEE ON NUCLEAR WASTE

5 (ACNW)

6 + + + + +

7 133RD MEETING

8 + + + + +

9 THURSDAY,

10 MARCH 21, 2002

11 + + + + +

12 ROCKVILLE, MARYLAND

13 + + + + +

14 The subcommittee met at the Nuclear  
15 Regulatory Commission, Two White Flint North,  
16 Room T2B3, 11545 Rockville Pike, at 8:30 a.m.,  
17 George M. Hornberger, Chairman, presiding.

18  
19 COMMITTEE MEMBERS PRESENT:

20	GEORGE M. HORNBERGER	Chairman
21	RAYMOND G. WYMER	Vice Chairman
22	B. JOHN GARRICK	Member
23	MILTON N. LEVENSON	Member

24  
25  
**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

STAFF PRESENT:

JOHN T. LARKINS, Executive Director

SHER BAHADUR, Associate Director

HOWARD J. LARSON, Special Assistant

LYNN DEERING

LATIF HAMDAN

CAROL A. HARRIS

MICHAEL LEE

RICHARD K. MAJOR

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

(202) 234-4433

[www.nealrgross.com](http://www.nealrgross.com)

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

I-N-D-E-X

<u>AGENDA ITEM</u>	<u>PAGE</u>
Opening Statement by the ACNW Chairman . . . . .	188
Yucca Mountain Review Plan, Revision 2	
Presentations:	
Jeff Ciocco . . . . .	189
Banad Jagannath . . . . .	205
Tim McCartin . . . . .	211
Pat Mackin . . . . .	258
Jeff Pohle . . . . .	273

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

(8:36 a.m.)

CHAIRMAN HORNBERGER: The meeting will come to order. This is the third day of the 133rd meeting of the Advisory Committee on Nuclear Waste.

My name is George Hornberger, Chairman of the ACNW. The other members of the committee present are: Raymond Wymer, Vice Chairman; John Garrick; and Milton Levenson.

Today the committee will: 1) hear a presentation from the NRC staff on Revision 2 to the Yucca Mountain review plan, and 2) continue preparation of reports.

Richard K. Major is the designated federal official for today's initial session. This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act.

We have received no written comments or requests for time to make oral statements from members of the public regarding today's sessions. Should anyone wish to address the committee, please make your wishes known to one of the committee staff.

It is requested that the speakers use one of the microphones, identify themselves, and speak with sufficient clarity and volume so that they can be

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

(202) 234-4433

www.nealrgross.com

1 readily heard.

2 Let me get to my Thursday page. Today we  
3 are going to -- this morning we're going to have our  
4 long-awaited briefing on the Yucca Mountain review  
5 plan, and the Yucca Mountain review plan is quite  
6 important to the committee. It's obviously an  
7 important step for the NRC in preparing to review a  
8 potential or possible license application.

9 And I know we've talked offline with Jeff  
10 Ciocco, and we know that staff has been making lots of  
11 progress, and we're looking forward this morning to  
12 getting our first official briefing. And I understand  
13 that this is going to involve four or half a dozen  
14 people, and, Jeff, I'll let you introduce yourself,  
15 and you can orchestrate the dog and pony show.

16 MR. CIOCCO: Very good. Thank you, and  
17 good morning. My name is Jeff Ciocco. I'm the  
18 project manager responsible for the development of the  
19 Yucca Mountain review plan. Before I get into my part  
20 of the presentation, just let me tell you what we're  
21 going to cover this morning.

22 We're going to cover -- we're going to do  
23 an introductory presentation. We're going to have a  
24 presentation on the repository safety prior to  
25 permanent closure, and that's our preclosure. And

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that is -- Banad Jagannath over there is going to  
2 present it. We've got a postclosure presentation by  
3 Tim McCartin.

4 We have performance confirmation and a  
5 research and development program to resolve safety  
6 questions by Pat Mackin. And then we have a brief  
7 presentation on the quality assurance.

8 Let me tell you some of the materials that  
9 we put up in the back of the room, as well as on your  
10 deck. You got a briefing packet which contains all  
11 five presentations. We'll go through it, and we can  
12 orient you.

13 I also put back there a copy of the press  
14 release dated March 4th of this year, which the  
15 Commission announced a release of public availability  
16 of the Yucca Mountain review plan, as well as hard  
17 copies of the actual plan back there. There are  
18 several on the floor, and that's the same version  
19 which is up on the website right now.

20 I also want to say that the development of  
21 the Yucca Mountain review plan -- you're going to hear  
22 about five presenters here this morning. However,  
23 this is really a team effort from the Division of  
24 Waste Management as well as experts from the Fuel  
25 Cycle Safety and Safeguards Group, who wrote the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 emergency planning, physical protection, and the  
2 material control and accountability.

3 And we have staff here at the NRC, as well  
4 as our counterparts at the center in San Antonio. So  
5 this was really a team effort, and Pat Mackin is the  
6 co-project manager from San Antonio. But it's really  
7 the staff who put the pen to the paper, and then in  
8 many -- at many times they also pointed at Pat and I.

9 But, really, what you're going to hear  
10 today is presentations from the primary authors and  
11 those people responsible, but there is a whole slew of  
12 cast.

13 So let me go ahead and start the  
14 introduction.

15 MEMBER GARRICK: Are you saying it's  
16 really their fault?

17 (Laughter.)

18 MR. CIOCCO: No. I'm really the YMRP  
19 apologist, so I'll take responsibility.

20 As far as the briefing agenda this  
21 morning, for the introduction, I'll go through the  
22 status and structure of the review plan, what our  
23 philosophy was in its development, how the YMRP will  
24 change, it's going to be a living document, and the  
25 different types of reviews.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           We're going to conduct an acceptance  
2 review, a review for general information, and the  
3 administrative program requirements, as well as a  
4 little bit about what the step-wise licensing approach  
5 is in Part 63 and how that is covered under the Yucca  
6 Mountain review plan.

7           Here is the status of the Yucca Mountain  
8 review plan. We last briefed you back in March of  
9 2000. At that time, I think we gave you an overall  
10 outline of the Yucca Mountain review plan. It was  
11 currently under development. The Yucca Mountain  
12 review plan draft Revision 1 was made public for  
13 information only back in November of last year.

14           It wasn't consistent with the final Yucca  
15 Mountain regulations, and that was sort of an  
16 unauthorized release of the Yucca Mountain review  
17 plan. So the Commission decided to make it publicly  
18 available.

19           Right now, we're at the Revision 2. It's  
20 a draft report for comment. It's currently available  
21 on the NRC's public website, and there are copies  
22 provided in the back of the room as well. There will  
23 be a NUREG released by the end of March, followed by  
24 a Federal Register notice and request for public  
25 comments.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           Now, some of the members here have  
2 received the actual NUREG. It's just coming off the  
3 press right now, and there is about 1,300 copies being  
4 shipped. If you're on the mailing list, if you're on  
5 any kind of list, chances are you're going to receive  
6 the actual NUREG and it looks like this.

7           It's identical in page numbers to what's  
8 in the back of the room here, and there's also  
9 instructions in there. You can contact me or contact  
10 distribution here and get a copy of it.

11           Here's the structure of the review plan,  
12 and we're going to go through some of this today. But  
13 it's basically set up -- Chapter 1 is the  
14 introduction. Chapter 2 is an acceptance review.  
15 Chapter 3 is the review plan for general information.  
16 And Chapter 4 is the review plan for the safety  
17 analysis report. And this is structured according to  
18 Part 63, Section 21, which is the content of the  
19 license application.

20           Really, the acceptance review is for  
21 docketing, and the review plan for general information  
22 in 63.21 is Section B, and it contains the elements of  
23 a general site description, proposed schedule for the  
24 construction, the physical protection plan, material  
25 control and accountability, and description of the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 site characterization work.

2 And the safety analysis report, which is  
3 63.21 in Part C, contains several sections. One is  
4 the preclosure repository safety before permanent  
5 closure. You'll see postclosure as the repository  
6 safety after permanent closure, the research and  
7 development program to resolve safety questions -- and  
8 these three will be covered today, as well as  
9 performance confirmation. And then the very last  
10 section is the administrative and programmatic  
11 requirements. And then we just have tiered down what  
12 the different sections are for preclosure and  
13 postclosure.

14 As far as each of the sections of the  
15 Yucca Mountain review plan, they're really consistent  
16 if you're familiar with other standard reviews plans,  
17 whether for Part 70 for licensing of spent nuclear  
18 fuel, the MOX facility, they're all basically  
19 structured the same. They've got the areas of review,  
20 which are the topical areas, and the scope of the  
21 review. It's got the review methods. Really, it's  
22 for the staff to use. They're step-by-step  
23 procedures.

24 And the level of detail and complexity of  
25 the review methods are determined by the requirements

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 and the nature of the technical issues. You'll see a  
2 lot more in the review methods in postclosure and  
3 preclosure than you will see for the areas of general  
4 information.

5 It contains acceptance criteria, which  
6 defines what is an acceptable compliance  
7 demonstration. And the acceptance criteria in the  
8 review plan are based on regulatory guides and the  
9 requirements of the rule, any codes or standards, and  
10 the results of staff investigations.

11 We've been doing prelicensing interaction  
12 for over 15 years, and a lot of the criteria are what  
13 were developed in the issue resolution status reports,  
14 the IRS ARBs. And then there's the evaluation  
15 findings section, which is the examples of the -- or  
16 it does contain examples of the general findings  
17 suitable for a safety evaluation report, and then it  
18 contains references. And this is standard throughout  
19 the review plan for all of the sections.

20 A little bit of the regulatory philosophy  
21 in setting up the review plan. We received a lot of  
22 guidance from the Commission, as well as management.  
23 The licensing review philosophy for the NRC, we did  
24 not select the sites or designs. The NRC reviews are  
25 comprehensive. We will cover every section of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Part 63.21 in a license application. We will focus on  
2 areas most important to safety or waste isolation in  
3 those reviews.

4 NRC defends its licensing decisions. It's  
5 up to DOE to defend its own safety case. We have to  
6 look for reasonable assurance, and that's in  
7 preclosure area, and reasonable expectation, and  
8 that's postclosure, of compliance.

9 The Yucca Mountain review plan implements  
10 Part 63, which is the risk-informed, performance-  
11 based, site-specific rule. And it incorporates more  
12 than 15 years of staff knowledge, and it doesn't  
13 contain prescriptive acceptance criteria.

14 The subsequent presenters are going to  
15 cover the different aspects in their particular areas,  
16 get into how that's risk-informed and performance-  
17 based.

18 We'll continue along with the regulatory  
19 philosophy. The general review process, if there is  
20 a license application for Yucca Mountain, and  
21 prescribed in the review plan, will conduct an  
22 acceptance review for docketing. It's a 90-day  
23 review. If it's docketed, we'll conduct a detailed  
24 technical review, prepare a safety evaluation report,  
25 and then, if necessary, we will develop a request for

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 additional information.

2 That could also happen in the acceptance  
3 review. There could be requests for additional  
4 information in the acceptance review. This is  
5 standard NRC licensing.

6 CHAIRMAN HORNBERGER: Does that change the  
7 90 days, if you request additional information in the  
8 acceptance review?

9 MR. CIOCCO: Yes, I think it does have --  
10 yes, if there is additional time needed.

11 The use of the risk-informed, performance-  
12 based measures, this is just kind of an overview.  
13 We'll get into more detail in each of the areas. But  
14 the review methods and the acceptance criteria are  
15 focused on assessing compliance with the performance  
16 objectives in Part 63.

17 The postclosure safety, a separate section  
18 for the areas that the staff has determined to be most  
19 important to waste isolation -- and this results from  
20 the key technical issues, from the issue resolution  
21 status reports, and the more than 15 years of  
22 prelicensing.

23 The acceptance criteria are flexible  
24 rather than prescriptive. DOE always has the option  
25 of not using the Yucca Mountain review plan, but they

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 must defend a safety case. DOE must select compliance  
2 demonstration methods, show they are appropriate, and  
3 use them properly in their safety case.

4 We do a lot of cross referencing between  
5 the sections of the review plan, and it was also  
6 written to address any step of licensing -- and I've  
7 got a couple of slides later on that will explain the  
8 different step-wise licensing approaches in Part 63  
9 and how the Yucca Mountain review plan will  
10 accommodate that.

11 YMRP is a living document and will change.  
12 Revision 2 is a draft report for comment. We will  
13 seek public comment in the ACNW review. I expect  
14 after this NUREG 1804 completes its distribution we'll  
15 issue a Federal Register notice and then seek a 90-day  
16 public comment period. And we're also going to have  
17 public meetings in and around Las Vegas during the  
18 public comment period to get their feedback.

19 NRC staff will incorporate the comments as  
20 appropriate, and we will provide the revised document  
21 back to the Commission. This is how the document  
22 would change in light of the September 11th terrorist  
23 attacks, that the Commission has directed the staff to  
24 conduct a comprehensive evaluation of our physical  
25 protection programs. If these efforts indicate NRC

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 regulations need revision, we'll go through the  
2 appropriate method and that could dictate a change to  
3 the Yucca Mountain review plan.

4 It could also change because of the multi-  
5 step licensing process, and Part 63 also provides  
6 opportunities for us to revise the Yucca Mountain  
7 review plan.

8 An acceptance review -- the first step in  
9 the review -- it's the first screening of DOE's  
10 license application using the acceptance checklist,  
11 which is based on 63.21. It's a checklist that goes  
12 through all of the general information. There's I  
13 think five or six sections, as well as the 14 or 15  
14 sections of the safety analysis report. And this is  
15 all under Chapter 2 of the Yucca Mountain review plan.

16 It determines completeness of the  
17 information, that the information must be sufficient  
18 to permit a safety review, 90 days are allowed, and  
19 the results of this we either accept for review and  
20 docketing, we accept but request additional  
21 information, or we reject because there's inadequate  
22 information to support a detailed safety evaluation  
23 report.

24 Now we're getting into Chapter 3 of the  
25 Yucca Mountain review plan. It's the review for

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 general information. It examines the overview  
2 information for the site and design, and a lot of  
3 these aren't detailed technical reviews either. There  
4 is a general description of the site. There are  
5 proposed schedules for construction, receipt, and  
6 emplacement of waste, which isn't a technical review,  
7 because this information is really reviewed in detail  
8 back in preclosure and postclosure sections of the  
9 Yucca Mountain review plan. It's just general  
10 information.

11 The physical protection requirements --  
12 and Part 63 refers up to the safeguards section of  
13 Part 73, material control and accountability, which is  
14 I think found under Part 72, which is independent  
15 spent fuel and high-level waste investigations, as  
16 well as a description of the site characterization  
17 work. Once again, most of these aren't detailed  
18 reviews.

19 Now, this is Section 4.5, the very last  
20 section of the Yucca Mountain review plan. It's to  
21 review for administrative and programmatic  
22 requirements. It includes a lot of operational  
23 requirements. This is where you'll find the quality  
24 assurance, expert elicitation, emergency planning, and  
25 there's a whole list here.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           And none of these have any performance  
2 objectives in Part 63. We use existing NRC programs  
3 and look for opportunities to modify any kind of  
4 prescriptive criteria. For instance, the emergency  
5 planning, we use what's -- I guess it's in I think  
6 Part 72 as well in this section.

7           As far as a multi-step licensing approach,  
8 it's important to understand that the Yucca Mountain  
9 review plan is going to be used if there is an  
10 issuance of a construction authorization. Following  
11 that could be a license to receive and possess. So  
12 Part 63 allows for well-defined steps in licensing  
13 with incremental decision points that allow for  
14 continual learning and progressive confidence.

15           Three steps in licensing -- maybe it's  
16 four -- there is also license for termination. But  
17 the first step under 63.31 is the construction  
18 authorization, which is based on the site  
19 characterization results -- is the reasonable  
20 assurance and the reasonable expectation that waste  
21 can be disposed at no unreasonable risk to health and  
22 safety of the public.

23           The second step would be the license to  
24 receive and possess, 63.41, which is informed after  
25 construction activity, and it's really based on, are

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the underground systems for initial operation  
2 substantially complete?

3 And then you have the amendment for a  
4 permanent closure in 63.51, which is updated by  
5 information to the license to receive and possess. It  
6 has information from the performance confirmation,  
7 data obtained from the operational experience, and  
8 then 63.52, which I didn't leave here, I think is the  
9 license for termination. So it's a three- or four-  
10 step, depending on how you look at it.

11 CHAIRMAN HORNBERGER: Jeff, the words  
12 there post-permanent closure monitoring program, so  
13 there is a provision for monitoring in perpetuity or  
14 something?

15 MR. CIOCCO: Yes. In 63.51, I think they  
16 have to describe what long-term monitoring program  
17 they will have, whenever there is an amendment for  
18 permanent closure.

19 MEMBER GARRICK: What do you mean by  
20 informed by construction activity, etcetera?

21 MR. CIOCCO: That is -- for the updated  
22 license application, informed means they need to  
23 include data obtained during construction, performance  
24 confirmation, whenever they update their performance  
25 assessment at this stage. So it's informed from

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 information that was gained along the construction  
2 authorization. They still need to -- they need to  
3 demonstrate performance compliance.

4 So this is how the Yucca Mountain review  
5 plan -- staff intends to use the review plan to  
6 conduct reviews of the potential application with  
7 respect to construction authorization, license to  
8 receive and possess. Although there are some  
9 differences in the requirements for construction  
10 authorization and the license to receive and possess,  
11 they are really very similar to where we can use the  
12 evaluation of findings for both cases.

13 Accordingly, the evaluation of findings  
14 contained -- they were prepared to be suitable for  
15 both reviews. It's reasonable to expect that we would  
16 have revisions if there was a construction  
17 authorization. As we learn as we go along, we may --  
18 you know, we may revise the Yucca Mountain review plan  
19 after that.

20 And this is just kind of a side note, but  
21 at the time of the review, if there is a construction  
22 authorization, several aspects are really based on a  
23 commitment by DOE rather than hard evidence, such as  
24 the training program, material control and  
25 accountability, personal qualifications. But at this

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 point, they're just in construction. They don't have  
2 their personnel on board yet. They are really not  
3 implementing their plan yet.

4 So that was -- that's it for the  
5 introduction. It was kind of just meant to be an  
6 overview of the content of the review plan, how it's  
7 going to be utilized. Next, we'll get into the  
8 preclosure, and then postclosure.

9 Do you have any questions on the  
10 introductory material?

11 CHAIRMAN HORNBERGER: Does anybody have  
12 any questions on the general overview? No?

13 MEMBER LEVENSON: The page numbers for the  
14 committee members -- the page numbers in the bound  
15 copy are not the same as in the hard copy we received  
16 previously. So if you have comments from pages, they  
17 are --

18 MR. CIOCCO: Yes. I'm not sure what  
19 version you received earlier.

20 MEMBER LEVENSON: It's draft Revision 2.

21 MR. CIOCCO: Yes. That may be one that I  
22 gave you. Yes. I checked this morning -- well, the  
23 ones that are back here, the ones we printed off the  
24 internet, they were the same page numbers.

25 MEMBER LEVENSON: I checked what was lain

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 in front of me this morning, and it was --

2 MR. CIOCCO: Okay. Well, whatever I can  
3 do to facilitate your review, we will certainly do  
4 that.

5 Okay. Next, I'll introduce Banad, who is  
6 going to do the preclosure.

7 CHAIRMAN HORNBERGER: Jeff, I had I guess  
8 one quick question. Particularly I guess in -- it  
9 struck me when I looked at your list for the review  
10 for administrative and programmatic requirements. A  
11 lot of that information you will have vetted prior to  
12 a license application, right? And I think of things  
13 like expert elicitation.

14 MR. CIOCCO: Right. Yes, absolutely. I  
15 didn't -- I wasn't trying to imply that all of the  
16 sections are a commitment. A lot of that information  
17 we'll have, right, for the safety evaluation report.

18 MR. JAGANNATH: Good morning. I am Banad  
19 Jagannath. I will briefly present the preclosure part  
20 of the Yucca Mountain review plan.

21 My outline basically contains organization  
22 of preclosure safety assessment review, and then how  
23 -- the risk-informed, performance-based aspect of it.  
24 10 CFR 63.21(c)(5) requires the performance of  
25 preclosure safety analysis of the repository

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 operations area prior to permanent closure.

2 If you look at the big chart Jeff put out,  
3 the preclosure area contains one preclosure safety  
4 assessment plus another block for retrieval  
5 operations, another block for dismantlement,  
6 decommission, and decontamination activities. These  
7 are three distinct components of the preclosure  
8 requirement. Our main focus will be on the preclosure  
9 safety assessment.

10 Preclosure safety assessment is defined as  
11 a systematic examination of the site design, the  
12 potential hazards, consequences, initiating events,  
13 and the potential dose resulting from the  
14 consequences. Systematic consideration of all these  
15 things in arriving at the decision in terms of  
16 performance components.

17 Part 63 is a dose-based rule, in that the  
18 licensee is supposed to demonstrate compliance with  
19 the performance objectives, permissible doses to  
20 workers and the public.

21 Following the logic of the definition in  
22 the preclosure safety assessment, this is how the  
23 review plan is arranged. It's like a sequence of  
24 evaluations you go through, what I would define a  
25 conclusion. Basically, the first piece, chapter on

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 site description as it pertains to safety analysis.  
2 This chapter has all of the site information, starting  
3 from geology, hydrology, rock, seismology, all those  
4 things.

5 The information presented and the  
6 evaluation will be as appropriate for future  
7 evaluations. This provides an input for the safety  
8 analysis.

9 The second section is a description of  
10 structure, systems, components, equipment, and  
11 operation of process activities. This is the design  
12 information you need to be able to use the site  
13 information and design information for the evaluations  
14 in the safety assessment.

15 Again, depending on how it is used, the  
16 information should be enough for the staff to  
17 understand what's being done there and be able to come  
18 up with -- make further safety evaluations. Some  
19 areas there will be more details. Some areas there  
20 will be less details. But it's dependent on the topic  
21 of the structures.

22 The next one is hazardous items,  
23 additional hazards, and the initiating events. These  
24 are both natural and human hazards. These are under  
25 external and internal. These are all considered

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 initiating events.

2 Then, comes the chapter on event  
3 sequences. But considering the initiating events,  
4 then the operations of the facility and the facility  
5 descriptions, you come up with the initiating event  
6 that would ultimately pose a radiation exposure dose.

7 And at the end of the initiating event  
8 sequences, you have possibility for any event  
9 sequence, a frequency at which it will occur. And  
10 based on the scenario at which it ends up, you will  
11 have in the next section a talk on the consequences.  
12 You evaluate the consequences, which are -- it goes to  
13 public and workers.

14 And this dose is the one that we use in  
15 demonstrating compliance with the performance  
16 objectives. And then these are I guess the numerical  
17 radiation limits in the 10 CFR 63, and also these are  
18 the -- field doses are for Category 1 and Category 2  
19 event sequences. That's what you'll find out.

20 This is the demonstration and compliance  
21 in terms of dose as it is -- part of this analysis  
22 will be a combination of event sequences, and the dose  
23 is identification of structure, systems, components.

24 The next section is the one --  
25 identification of structure, system, components

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 important to safety, and safety controls and measures.  
2 This comes out of the information from the event  
3 sequences and the dose consequences. A combination of  
4 these two will identify what are the important  
5 structure, systems, and components.

6 MEMBER LEVENSON: Excuse me. I have a  
7 question about that last bullet -- by experience, and  
8 historically we know what important to safety tends to  
9 mean in the reactor world, something leading to core  
10 damage, etcetera. Is there a definition here for what  
11 is important to safety in such a completely different  
12 category?

13 MR. JAGANNATH: Here, the important to  
14 safety is any structure or component needed to be able  
15 to receive, handle, pack, and dispose of the waste.  
16 That's for important to safety. And the other one is  
17 the important to containment, waste isolation. There  
18 are two requirements of --

19 MEMBER LEVENSON: Well, my question is  
20 slightly different in that the section in the draft  
21 report identifying things important to safety, some of  
22 them seem to be things that if they failed might lead,  
23 at most, to injury or death of one employee. That  
24 seems to be a far different interpretation of  
25 important to safety than in the reactor business.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. JAGANNATH: Here, important to safety  
2 is defined in terms of the dose, not in terms of risk  
3 as a question of that. The dose is based on  
4 consideration of risk, but the rule requires us to  
5 comply with the dose.

6 Basically, if an event sequence leads to  
7 a release which is in excess of the dose, we make sure  
8 the design and structure -- the dose is less than the  
9 limit in the requirements.

10 MEMBER LEVENSON: The dose to which the  
11 facility should be regulated, do you mean?

12 MR. JAGANNATH: Yes. The design has to  
13 comply with the performance objectives.

14 MEMBER LEVENSON: Yes, okay. But my point  
15 is that injury to an employee inside the plant is  
16 significantly different than the dose to people 18  
17 miles away.

18 MR. JAGANNATH: Yes. This comes under  
19 Part 20 regulations. That has different dose limits,  
20 different procedures.

21 MEMBER LEVENSON: Okay.

22 MR. JAGANNATH: Safety does not go in  
23 terms of that. We have consideration of Part 20 as  
24 one of the requirements. That also will be a  
25 consequence.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MEMBER LEVENSON: Yes. My point was that  
2 there is some things identified as important to safety  
3 that I don't think by any stretch of the imagination  
4 can lead to an off-site release, and yet they are  
5 listed as important to safety.

6 MR. JAGANNATH: The work done by DOE is  
7 based on community analysis, judgments. They went  
8 through a whole list just to get started. It's not a  
9 final list.

10 CHAIRMAN HORNBERGER: Banad, are you  
11 saying that you -- there are occupational exposures  
12 that are taken into account as well? This would be  
13 the -- this would not be the 25 millirem?

14 MR. JAGANNATH: No, no. This is  
15 15 millirem. Part 63 also requires compliance with  
16 Part 20, which is worker dose requirements that they  
17 also comply with. We just -- you know, in  
18 discussions, we always focus on the public dose. But  
19 Part 20 is also part of the requirements, compliance  
20 with that and also compliance with ALARA requirements.

21 CHAIRMAN HORNBERGER: Does that make sense  
22 to you, Milt, that they would have as their safety  
23 case the occupational exposure?

24 MR. McCARTIN: Well, yes. Tim McCartin,  
25 NRC. 63 does define important to safety, and it's

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 with respect to meeting the dose limits for Category 1  
2 and Category 2 events, which are the off-site doses.

3 MEMBER LEVENSON: Well, then, I guess the  
4 question is, when you get to the detail level, is  
5 whether things now on the important to safety list are  
6 correct based on that definition.

7 MR. JAGANNATH: Both compliance with doses  
8 and Part 20 are considered in arriving at the safety  
9 items.

10 This list of items important to safety are  
11 also for their use down the line in dividing them into  
12 in terms of categories and for quality assurance  
13 purposes.

14 Continuing, the next chapter is a design  
15 of these structure, system, and components, which are  
16 identified as important to safety. These are --  
17 supposedly, these are the ones that have to be  
18 functional all the time. So we want to make sure they  
19 are designed properly. We see deterministic are  
20 prescriptive, present an evaluation for them.

21 And there is another subitem. As part of  
22 the compliance with 10 CFR Part 20, there is a  
23 requirement for compliance with ALARA requirements.  
24 It is as low as reasonably available. This doesn't  
25 have that much of force -- prescriptive requirements.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 But, still the design has to comply with these things.  
2 So we looked at the design from that perspective also.  
3 That's another separate chapter within the preclosure  
4 safety assessment.

5 The other two big sections outside of the  
6 preclosure safety assessment -- one, plans for  
7 retrieval and storage of radioactive waste. This is  
8 required in the regulation. And the other one is  
9 plans for permanent closure and decontamination or  
10 decontamination and dismantlement of surface  
11 facilities. This kind of mentions the several  
12 sections in the Yucca Mountain review plan.

13 This one is like a block diagram.  
14 Basically, it shows the logic within the review plan.  
15 This follows the same logic as the definition of the  
16 preclosure safety assessment. You'll note that  
17 there's a dotted line at the bottom with two blocks  
18 outside. One is the retrieval plan; another is the  
19 permanent closure at the very end.

20 Above the dotted line are the several  
21 blocks which contain so-called Yucca Mountain  
22 preclosure certification study. Each of these blocks  
23 has a corresponding section in the review plan, except  
24 the first block has two sections. One is a site  
25 description; the second is a design. And the last two

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 blocks, which are design basis criteria and the design  
2 review, that is one chapter. So there are 10 chapters  
3 with 10 blocks in there.

4 This follows the same logic of a site  
5 description/design description. The next one is the  
6 potential hazards. That leading to the next one is  
7 the identification of emergency consequence, and  
8 categorizes them as Category 1 or Category 2. Then,  
9 the consequence evaluation.

10 Based on the results of those things, you  
11 identify the structure, systems, components, important  
12 to safety. There is another concurrent review of the  
13 ALARA as a part of that.

14 This leads to establishment of design  
15 criteria and the design of the structure, system, and  
16 components required in safety. All of these are part  
17 of the preclosure safety analysis.

18 One of the end products is the so-called  
19 Q list, which contains the so-called safety items.  
20 Another subgoal out of that would be further  
21 development and validation of this based on the  
22 important to safety and risk significance. This is  
23 the whole logic of the preclosure portion of the  
24 review plan.

25 I'll talk about how the risk-informed,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 performance-based approach is taken. Basically, the  
2 purpose of the review is to evaluate compliance with  
3 the Part 63 dose requirements. One is the dose  
4 requirements of the public and workers, ALARA  
5 considerations.

6 These also are based on risk from  
7 radiation exposure. That's mainly considered risk in  
8 the dose consequence.

9 Part 53 has a definition of preclosure  
10 safety, how we do that. It's, again, a systematic  
11 examination of the site design, hazards, initiating  
12 events, the event sequences. In that also we consider  
13 the -- in going through these things, we consider the  
14 uncertainty in data when you go through these things.

15 And then you find the event sequences.  
16 The event sequences are defined on methodologies used  
17 in PRA, you know, all those technical methodologies.  
18 We use them in the event sequences.

19 Depending on the event sequences, you may  
20 use the dose consequences. These dose consequences  
21 and the unit sequences, in terms of the category they  
22 are used, further in identifying structure, systems,  
23 components, important to safety. And those -- they  
24 are touch and go for the design of the same thing,  
25 which are required in safety.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           And the results of the design may be  
2 linked to greater quality assurance. The results may  
3 be used in that part.

4           This is the whole focus. The staff review  
5 will focus on how DOE performs their preclosure safety  
6 assessment. And then, our review will be -- it  
7 depends on the relative significance within that  
8 safety system or safety components.

9           MEMBER GARRICK: How much knowledge did  
10 the team have of how DOE proposes to do their safety  
11 analysis in the preparation of your approach to do  
12 preclosure safety analysis?

13           MR. JAGANNATH: We had one detailed  
14 technical exchange last year. There were several  
15 interactions. DOE, as a result of the detailed  
16 technical exchange where we expressed a lot of our  
17 concerns on their proposed methodology. They will  
18 produce the so-called PCSA guidance document,  
19 preclosure safety assessment document.

20           It is for their internal staff use, but it  
21 may be something similar to our review plan for their  
22 staff. We just brought it to -- like a read back. We  
23 are not -- that was their document. We plan to review  
24 it thoroughly. They expect our feedback, that at the  
25 end we would have a thorough knowledge of what

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 approach we are taking.

2 Based on the discussions going on, they  
3 are considering the hazards. They want systematic  
4 hazards, initiating events. They are considering  
5 uncertainties in the data, failures in terms of the  
6 combinations that they use, all the things you would  
7 do in a systematic way they are approaching.

8 MEMBER GARRICK: So both approaches seem  
9 to be --

10 MR. JAGANNATH: Parallel?

11 MEMBER GARRICK: Yes. And somewhat rooted  
12 in the process hazards analysis, integrated safety  
13 analysis way of looking at things, right?

14 MR. JAGANNATH: Well, it is. I don't want  
15 to put a label on one of those things, but we are  
16 considering all of the components of these things. So  
17 structure, system, description, the hazards, the  
18 frequencies, uncertainty in the event sequences. I  
19 really think those -- then, using all of these things  
20 together to identify important to safety.

21 We do not go in terms of risk at the very  
22 end, because it is not required, and the regulations  
23 kind of splits it in Category 2, so that -- it's a  
24 restriction on how we use the resource.

25 MEMBER GARRICK: Okay. Thank you.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1                   MR. JAGANNATH:     In the review plan,  
2                   acceptance criteria are not very prescriptive.  Since  
3                   it is a risk-informed, performance-based approach, we  
4                   are left in a fairly general level.  We are  
5                   identifying what needs to be reviewed, and DOE has the  
6                   flexibility to come up with their own design criteria  
7                   as long as they can justify it and demonstrate that  
8                   they are used properly.

9                   The staff review will be focused on the  
10                  safety-related items.  We have developed what we call  
11                  a PCSA tool.  It's like a software with a lot of  
12                  modules in it, where you store the information ahead  
13                  of time, the description data, event sequences, and  
14                  it's a module of software to do the event tree/fault  
15                  tree analysis.  That part of it is another module  
16                  which can calculate the doses.

17                  Then, the interpretation of the results we  
18                  use -- the tool does not interpret the results.  We  
19                  interpret the results to come up with safety items.  
20                  And, again, for the analysis we can come up with the  
21                  quality degradation system.

22                  Our review will be focused.  It's like a  
23                  confirmatory tool.  This preclosure review is more  
24                  than just using the PCSA tool.  There are other areas  
25                  which are done outside of this tool.  So this is --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that is where the -- in the context of the review,  
2 that's where the tools are really focused on.

3 All of these things we have plans for  
4 retrieval and alternate storage. Again, there are no  
5 prescriptive criteria. DOE has the flexibility. We  
6 only require the plan from them. The plan has to  
7 demonstrate that the retrieval operation will comply  
8 with the performance of the reviews, and it's  
9 something feasible.

10 The next one is plans for permanent  
11 closure, decontamination, and dismantlement. Again,  
12 the acceptance criteria are fairly at an acceptable  
13 level. We expect this part of the plan to be really  
14 general. Towards the end, they will finalize it. The  
15 design has to consider the dismantlement,  
16 decontamination, initially as one of the activities  
17 coming up. That's why we bring it up. And there are  
18 some NUREGs available. Hopefully, they will follow  
19 all of those things.

20 This concludes my brief presentation of  
21 what's in the preclosure plan. Mostly this is risk-  
22 informed performance, because we do not have any  
23 prescriptive requirements. They consider all of the  
24 aspects of risk in terms of hazards, initiating  
25 events, frequencies coming out of that. It's totally

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 performance-based, because the demonstrating comes  
2 from the dose.

3 CHAIRMAN HORNBERGER: Thank you, Banad.

4 MR. JAGANNATH: Do you have any questions?

5 CHAIRMAN HORNBERGER: Questions? Milt?

6 MEMBER LEVENSON: Yes. I have one, which  
7 is really not directly related to your presentation  
8 but curiosity. I know there are restrictions on what  
9 you can put in Yucca Mountain to some extent. The  
10 last bullet -- you're going to have a mountain full of  
11 very, very high-level, etcetera. Would it be possible  
12 at the end to dismantle that equipment, move it into  
13 the shafts before you seal it, rather than undertaking  
14 shipping stuff to new sites and new sets of  
15 regulations, and new everything.

16 MR. JAGANNATH: You don't know what will  
17 happen until years from now.

18 MEMBER LEVENSON: No. I'm wondering if  
19 legally there was a restriction against that.

20 MR. JAGANNATH: No. At this point, there  
21 is no restriction. The regulations are fairly  
22 straightforward. Our guidance is for whatever they  
23 use for the -- in the powerplant decommissioning  
24 guidance at this point.

25 The only requirement is that the design --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 they should have it in mind that we -- the designer  
2 keeping that in mind.

3 MEMBER LEVENSON: Yes. The point is that  
4 if you design it to be dismantled and shipped a long  
5 distance, the design might be quite different than if  
6 you had the ability to just move massive pieces of it  
7 into the drift and leave them there. So it does  
8 impact the design.

9 MR. JAGANNATH: I expect DOE plans to put  
10 it in the repository, but we'll know that when they  
11 submit the application.

12 CHAIRMAN HORNBERGER: You'd prefer not to  
13 see it shipped --

14 (Laughter.)

15 -- right? Tim?

16 MR. McCARTIN: Tim McCartin, NRC staff.  
17 I'd just like to correct what I said when I talked  
18 about the important to safety. For Category 2 events,  
19 it is off-site doses. Category 1 does include both  
20 worker and off-site doses, so we would look -- during  
21 normal operations, worker safety doses would be a  
22 factor in determining important to safety.

23 MEMBER LEVENSON: Is that the same  
24 criteria used on reactor plants?

25 MR. JAGANNATH: Part 3 of the reactor.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. McCARTIN: Apparently, no.

2 CHAIRMAN HORNBERGER: The question was the  
3 phrase "important to safety," I think, not protecting  
4 workers.

5 MR. JAGANNATH: Protecting workers is --

6 CHAIRMAN HORNBERGER: No. Protecting  
7 worker health and safety is a whole separate category.  
8 It may or may not be more restrictive. But importance  
9 to safety has a very specific connotation, and it just  
10 seems to me we're using a completely different  
11 definition here than the reactor field, and I'm  
12 wondering why.

13 MEMBER LEVENSON: Well, it is defined in  
14 63, and that was the definition we proposed. So we --  
15 I don't believe we got any comments on that particular  
16 definition.

17 CHAIRMAN HORNBERGER: Other questions for  
18 Banad?

19 MEMBER GARRICK: Well, I have some  
20 questions about the details of the procedure, but I  
21 think they are better dealt with offline, because they  
22 are -- they would be technical. So I think I'll  
23 defer.

24 MR. JAGANNATH: I'll be glad to meet with  
25 you.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 CHAIRMAN HORNBERGER: Do you mean they  
2 have to do with probabilistic risk assessment?

3 MEMBER GARRICK: No, because they don't do  
4 that. It's a little -- it does have to do with how  
5 they structure their scenarios and some of the  
6 different modeling. And I would prefer to talk to  
7 some individuals about that than take the time of the  
8 presentations.

9 CHAIRMAN HORNBERGER: Can you give me an  
10 example of a Category 1 event and how that would be  
11 handled? Just to lend some concreteness here.

12 MR. JAGANNATH: Category 1 is in the fuel  
13 handling building. Many times there are accompanying  
14 waste packages assemblies, dropping them in the dryer  
15 and the dry handling part of it. Category 1 is  
16 frequency less than  $10^{-2}$ .

17 CHAIRMAN HORNBERGER: Okay.

18 MR. JAGANNATH: In the same -- Category 2  
19 is -- has some events in the pool where the bare  
20 assemblies bump against each of the underwater -- they  
21 are -- some of them are Category 2.

22 CHAIRMAN HORNBERGER: Okay. So these  
23 kinds of events would be similar to events that would  
24 be encountered in other fuel handling facilities.

25 MR. JAGANNATH: Yes. But maybe it's more

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 moving, but in the same -- same kind of thing.

2 CHAIRMAN HORNBERGER: So I guess my point  
3 is that we -- there is not a lot that is "first of a  
4 kind" here. We have a lot of information and  
5 experience in dealing with these things.

6 MR. JAGANNATH: Correct. That was the  
7 basis for which our long-time -- it was put on the  
8 back burner in terms of resources and effort, because  
9 the agency has experience. This is something done at  
10 the powerplants and other facilities, moving fuel and  
11 handling fuel and other things.

12 There is some work done on this also. We  
13 intend to use all of those things. There is enough  
14 knowledge available. We have to use it appropriately  
15 as it applies to this case.

16 CHAIRMAN HORNBERGER: Questions from  
17 staff?

18 Okay. Thank you, Banad.

19 MR. JAGANNATH: Thank you.

20 MR. McCARTIN: Before I start, actually,  
21 if you have the complete set of the -- I actually have  
22 a separate set for my presentation. The one in -- the  
23 complete set is an earlier version.

24 CHAIRMAN HORNBERGER: You have a separate  
25 one.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. McCARTIN: Yes. Mine is Rev. 2.

2 CHAIRMAN HORNBERGER: Do you get away with  
3 changing your slides when you do presentations to the  
4 Commission?

5 MR. McCARTIN: No.

6 (Laughter.)

7 At least not at the last minute.

8 Okay. I'm going to try to walk through  
9 the postclosure safety assessment portion of the  
10 review plan today. And the presentation is decidedly  
11 short for all of the topics and the model abstraction,  
12 etcetera. I will -- that leaves more time for the  
13 committee to ask questions, and feel free to -- I'm  
14 sure you have no inhibitions about asking questions.

15 There are two main areas for the  
16 presentation. One, I'll talk about the organization  
17 of the safety assessment review, and then talk a  
18 little bit of how the risk information performance-  
19 based aspect of our review comes in.

20 First, in terms of the organization,  
21 obviously, the review plan is based on the compliance  
22 with the performance objectives. Then, the order is  
23 very important, and it was done for a very particular  
24 way. You'll see that second bullet is actually the  
25 first thing looked at -- system description and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 demonstration of multiple barriers.

2           Clearly, in terms of the analysis DOE has  
3 to do, this is probably the last section you write.  
4 We want to read it first, and that was done for a very  
5 particular reason. It basically is telling the big  
6 picture, the story of why the repository is working.  
7 Before we go into the other sections of the review,  
8 we'd like to get basically an overview of why the  
9 repository is working, and that's why that section is  
10 first.

11           We would expect the Department of Energy  
12 will be writing that section last, but we'll go  
13 through the multiple barriers. That information, that  
14 overview, is used to focus all the rest of the  
15 reviews.

16           Next, would be the scenario analysis,  
17 event probabilities. What have you considered? What  
18 have you included in the analyses? What have you not  
19 included in the analyses? Part of that right now is  
20 the identification of the events with probabilities  
21 greater than  $10^{-8}$  per year. As you know, we have a  
22 proposed amendment to 63 out there for unlikely  
23 events. That will come in. This section of the  
24 review plan would be revised depending on what that  
25 final rule amendment comes out as.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           Next, we go into model abstraction. These  
2 model abstractions were derived from the key technical  
3 issues. There are integrated subissues, we think, a  
4 little more related to -- a little better related to  
5 how we would do the review in terms of the different  
6 processes, aspects of the repository.

7           We think it gives us, as stated there, a  
8 comprehensive review of system behavior. We have  
9 everything on that list we think are the things we  
10 possibly need to look at in detail. Will we look at  
11 all those 14 subissues in the same detail? No. We  
12 want the list to be comprehensive. We will tailor our  
13 review, obviously, based on the multiple barrier  
14 aspect, what seems to be the most important to DOE  
15 making their safety case.

16           And we have cross-walked at times the KTIs  
17 and the subissues. We believe they are all captured  
18 there. You won't see that in the review plan. But  
19 the next slide I -- for completeness, I have the list  
20 of the 14 subissues. I don't know if there's any  
21 reason for going through all of them. I believe the  
22 committee has seen those before.

23           But we think the important point -- in  
24 this list, we believe we've captured all of the topic  
25 areas. And as I said, the importance for the review

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 plan is we want to be ready to review every one of  
2 those topic areas. The detail and depth we go into  
3 the review will depend on the risk importance of each  
4 of the subissues.

5 CHAIRMAN HORNBERGER: And these are your  
6 integrated subissues, is that right?

7 MR. McCARTIN: Yes.

8 CHAIRMAN HORNBERGER: The list?

9 MR. McCARTIN: Yes.

10 CHAIRMAN HORNBERGER: Okay.

11 MR. McCARTIN: And ultimately, at the end  
12 of the review plan for this section, you have  
13 demonstration with the standards. And there is three.  
14 One is the individual protection standard, the  
15 standards for human intrusion and the groundwater  
16 protection standards. That's pretty much the  
17 organization of the review plan.

18 Getting into more of the -- how is this  
19 structured in terms of the risk information?  
20 Obviously, at the top, we have the demonstration with  
21 the compliance, the numbers if you will. Related to  
22 that, there are three sub-tiers, and it all goes down  
23 to more detailed information. We have the multiple  
24 barriers, the model abstraction scenarios.

25 You can see that ultimately you get down

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 to each one of the model abstractions sort of fits  
2 into a box, be it model abstraction, some more than  
3 one box. Obviously, they all fit into multiple  
4 barriers in some way. But all of this information --  
5 the detailed model abstraction reviews all fall into  
6 this.

7 And I guess if there is one thing I'm  
8 hoping to make clear in this presentation, something  
9 that if there is one thing that I felt has been  
10 misinterpreted the most with respect to Part 63, is  
11 that demonstrating compliance with the performance  
12 objectives allows you not to understand fully the  
13 site.

14 And the entire approach that we laid out  
15 for postclosure I think give us the understanding of  
16 the site. That is first and foremost. Ultimately, we  
17 will look at the compliance with the numbers, but I  
18 know at different groups we've heard implied that the  
19 performance assessment is demonstration of compliance.  
20 The NEA peer review somewhat talked to, well, you're  
21 really -- if you're demonstrating compliance, you  
22 really don't need to understand the site.

23 I personally don't understand how you can  
24 make that assessment in looking at the rule and what  
25 is required. And I hope to go through some of the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 information that we're looking for. Ultimately, it's  
2 the understanding of the site.

3 The last thing you do is the calculation  
4 of the number. But the reason you believe and put  
5 trust in that demonstration is all of the information  
6 and understanding and --

7 CHAIRMAN HORNBERGER: Tim, let me ask you  
8 a quick question --

9 MR. McCARTIN: Sure.

10 CHAIRMAN HORNBERGER: -- on that point.  
11 Do you think that if you make conservative assumptions  
12 at every turn in the road that you'd get to understand  
13 the site?

14 MR. McCARTIN: That's a difficult  
15 question. However, I think you -- in your  
16 understanding, you need to allow for the fact that  
17 there could be some information that is difficult to  
18 attain, and you are left to take what you -- you might  
19 believe is a conservative approach.

20 You do have to have some information to  
21 defend that as conservative. If you're given that  
22 information, I still maintain that you do have a  
23 sense, an understanding of the site. And, in general,  
24 I look at the Commission's decision as one that is  
25 public health and safety protective. And that's their

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 decision to make.

2 In terms of if there are some conservative  
3 approaches, and truly we would not disagree that they  
4 are conservative, and you're still demonstrating that  
5 you can meet 15 millirem, I believe that's okay.

6 However, having said that, I will say that  
7 the part that -- I share the committee's opinion with  
8 the TSPA-SR. The word "conservatism" was used far too  
9 often, and what -- I interpreted "conservatism" in  
10 many documents is that we believe if we collected more  
11 information this parameter, this model, would become  
12 less conservative.

13 But you don't have that information.  
14 There is no guarantee that if you collect that  
15 information you may find out that that parameter  
16 actually that you thought was conservative is the  
17 correct value. And there is a lot of what I would  
18 consider putting in gut feelings into whether this is  
19 conservative. I would say I don't believe that's very  
20 useful.

21 MEMBER GARRICK: Isn't the issue, though,  
22 Tim, that often what the public is asking for is no  
23 uncertainty about the site. And, of course, that's  
24 completely unachievable. What's really important is  
25 how you represent the site.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           You don't need to know everything about  
2 the site to accurately represent what you do know  
3 about the site. And the way you do that is, of  
4 course, acknowledge and admit to the uncertainties.  
5 If you do that systematically and deliberately, you  
6 can represent what is known by the site in a rather  
7 convincing way.

8           But in order to do that you have to admit  
9 to these uncertainties. And I think that's where the  
10 confusion comes. I think this whole issue of  
11 precision is one of the most difficult to deal with,  
12 because in most engineering facilities it has not had  
13 to be dealt with in the same way that we're talking  
14 about here.

15           Even though the uncertainties existed,  
16 they were not -- there was not as much of an attempt  
17 to manifest them. And now we're pushing that here we  
18 have to manifest them, and so we need to make darn  
19 sure that there is an understanding of the difference  
20 between representing what is known about the site and  
21 conveying that the characterization of the site has  
22 been done such that there's no uncertainties about its  
23 features, and that's not the direction that we can go.

24           MR. McCARTIN: Yes. I agree completely.  
25 I think I've heard you say before, and maybe even

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 yesterday, to the Commission, we'd like to see the  
2 analysts take their best shot.

3 MEMBER GARRICK: Yes.

4 MR. McCARTIN: And I think that's what  
5 we're asking for in Part 63. We're pretty -- deal  
6 with the uncertainties. Give us your best shot. And  
7 I don't know if I like talking to conservatism,  
8 because I'm not sure I know what that means. But if  
9 you can talk to the evidence --

10 MEMBER GARRICK: Right.

11 MR. McCARTIN: -- and here is the evidence  
12 we have, and then let someone decide whether you've  
13 treated that evidence in an appropriate way or a  
14 conservative way. But that -- the word "conservatism"  
15 I think is troublesome. I prefer what the committee  
16 has said -- make it evidence-based, give us the  
17 evidence, and what you've done.

18 MEMBER LEVENSON: I think, as you know,  
19 Tim, I don't like the word "conservatism" at all. One  
20 of the things I've always recognized is that the non-  
21 uniform use of it, even if everything you do is  
22 "conservative," if they are non-uniform you can  
23 introduce risks.

24 I've recently been involved in a dose  
25 reconstruction project where there were 100 and some

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 isotopes. And, obviously, detail work couldn't be  
2 done on all, so there was a screening analysis to  
3 reduce it to a dozen that would be looking at in  
4 detail.

5 Because of non-uniform conservatism, in  
6 fact, a number of the more important isotopes were  
7 rejected as being not important. And so the non-  
8 uniform use of conservatism can introduce risks, and  
9 I think it's that that we're really concerned with.

10 MR. McCARTIN: Sure. And I would agree.  
11 And it may be one of those things -- I know we're  
12 internally thinking harder of describing our approach  
13 and what we're -- how we're dealing with uncertainty,  
14 which I think is the key. And I think we may have all  
15 in the PA area for Yucca Mountain taken a -- the easy  
16 way out and used the word "conservatism" far more  
17 liberally and in varied ways, and it has done a  
18 disservice.

19 And I believe when we've developed our  
20 code and parameters, I think the DOE -- I would like  
21 to think they're doing that. I have a lot of  
22 indication they are. But what you're looking to do is  
23 have a uniform level of support for what you're doing.

24 Because these problems are drastically --  
25 the areas that were involved, if you'll look at all of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 these different integrated subissues, they have  
2 drastically different uncertainties. And you've got  
3 different ways to treat it, but what we're looking for  
4 is a uniform level of support for the approach.

5 And then I have what I would maintain is  
6 some confidence in the final result. But, once again,  
7 I'm hoping that as I go further that it's the  
8 understanding that's at this level that feeds into  
9 this and gives you this number, and gives you some  
10 confidence. And it's all -- our regulation, I think,  
11 is directed towards getting that understanding.

12 One picture is worth a thousand words.

13 MEMBER GARRICK: That picture has a  
14 thousand words.

15 (Laughter.)

16 MR. McCARTIN: Yes. Well, that's true.

17 Once again, in looking at our review, and  
18 this first bullet with compliance with the performance  
19 objectives, it's really what I've been saying. I  
20 think the emphasis is on understanding the system.  
21 That's the way Part 63 was written. If you read the  
22 technical criteria, what we're asking in terms of  
23 support for assumptions and models, etcetera.

24 I know the committee has talked about --  
25 and also the TRB asked -- the TRB has talked about the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 community access to talk about multiple lines of  
2 evidence. I believe in the regulation we talk to  
3 things like laboratory field experiments, natural  
4 analogues. I'll show later where that sort of fits  
5 in, we think, in terms of providing additional  
6 support.

7           Once again, here is where -- and I talked  
8 to the TRB last month and brought up that the -- we,  
9 at the NRC, have never defined performance assessment  
10 in a narrow way. And so when we think of multiple  
11 lines of evidence, that's part of the TA. All of the  
12 information that supports the credibility and the  
13 belief in the modeling is part of PA.

14           I know that when the TRB talks about it,  
15 they speak of multiple lines of evidence separate from  
16 the PA. I think we're both after the same thing. I  
17 don't think there's a problem, but I believe we -- I  
18 think some of that may have developed to this -- the  
19 PA and demonstrating compliance doesn't get you the  
20 whole way. You need other information to make your  
21 safety case, if you will.

22           We sort of cloak all of this under the  
23 same you're demonstrating compliance. All of that  
24 information support is included.

25           As I talked about, the risk information is

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 used to focus the review. Multiple barrier analysis  
2 -- and you saw little -- we had some discussion  
3 yesterday about barrier analysis. The rule requires  
4 two things -- well, three things. Identify the  
5 barriers, describe the capability of the barriers, and  
6 provide the technical basis for that capability.

7 We believe providing that technical basis  
8 is really the same -- will be the same as the  
9 technical basis that's provided in the model  
10 abstraction aspect. So it's not really a separate  
11 kind of thing, and we mention that in the rule.

12 But it's important that we are looking at  
13 barrier capability. And I think the Commission -- we  
14 thought about what to do for barriers for the -- from  
15 the proposed rule all the way to the final, and it was  
16 debated internally. We had many discussions. We've  
17 thought about it a lot. I believe the Commission  
18 ended up where they should be -- at barrier  
19 capability.

20 Barrier capability is implying I have an  
21 understanding of what these barriers are doing. The  
22 reason I like that is that if you go to other things,  
23 such as just looking at the dose number in some cases,  
24 you can be misled.

25 And for the simple reason -- let's say

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 there's some radionuclides because of retardation  
2 never get out of the actual system. It's always zero.  
3 If you're just looking at the dose, you're totally  
4 opaque to the fact that the natural system is holding  
5 up those nuclides essentially forever, on the order of  
6 hundreds of thousands of years.

7 Just looking at the dose, you see iodine  
8 technetium. Well, the reason you see iodine  
9 technetium is they are very mobile. They're mobile  
10 just about everywhere in the world. There's a reason  
11 we see that. We didn't not bury this waste to retard  
12 iodine technetium. And so just looking at the dose  
13 can sometimes be misleading.

14 If you start describing the capability --  
15 and I have some slides later that will get into that,  
16 tell me what this barrier is doing and you can see  
17 that the barrier -- I know in terms of the simplified  
18 analyses you might just look at iodine technetium and  
19 neptunium. But in barrier capability, I think it  
20 would be very important.

21 There's a reason you don't have to include  
22 all of those other radionuclides. It's a natural  
23 system. And I think that description of that  
24 capability for the natural system to retard and hold  
25 up those nuclides is very important to the decision

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the Commission has to make. And I think in looking at  
2 the barriers you need that kind of information.

3 Obviously, the multiple barrier analysis  
4 will help -- as I said, that information helps focus  
5 the remaining -- all of the other reviews, be it model  
6 abstraction scenarios, etcetera. That's very  
7 important.

8 In terms of the scenario analysis, we have  
9 both the nominal and disruptive events. There really  
10 aren't that many disruptive events. But, certainly,  
11 in the nominal scenario, there is a plethora of  
12 processes to be considered. And there is a lot of  
13 evaluation there to look at what's included in the  
14 analyses and what is not.

15 And, ultimately, we think we'll be looking  
16 at unlikely and very unlikely events. And, as you  
17 know, the unlikely events would be screened from the  
18 human intrusion and groundwater protection analyses.

19 Model abstraction. Right now, we've done  
20 a lot of performance assessments -- the DOE has, NEI  
21 has. We've made use of all of that. I think there is  
22 prior information, prior knowledge that's used to help  
23 in developing this part of the review plan. There is  
24 no question that the model abstractions will have  
25 varying risk significance. Part of that depends on

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 what the DOE's safety case is.

2 When the application comes in, we think we  
3 have all of the right pieces here. We'll be able to  
4 tailor that analysis once the application is in. In  
5 terms of the abstraction, there is five aspects to  
6 each model abstraction that we look at, and here is  
7 where the understanding of the site comes in.

8 First, an adequate system description of  
9 model integration. Well, what does that mean? Well,  
10 we're looking for DOE to describe how they've -- for  
11 this subissue, how they've integrated into the whole  
12 analysis. We want to understand what they've done,  
13 how it relates to other aspects of the model, what  
14 feeds in, what feeds out, but getting an idea of what  
15 is being done in that system, that issue.

16 Next, we would look at, is there data in  
17 model justification for what they've done? Then, of  
18 course, getting to uncertainty, adequate  
19 characterization for the parameter uncertainty, and,  
20 as Dick Codell and Sitakanta pointed out yesterday,  
21 there are certain things we want to look at in terms  
22 of the risk dilution, etcetera. How are you  
23 specifying this range, etcetera? And there is things  
24 to be careful with in terms of arbitrarily expanding  
25 a particular range.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Model uncertainty -- as you know, the rule  
2 requires DOE to look at alternative models that are  
3 consistent with the information.

4 And, finally, adequate support for the  
5 model abstraction output. I think here, but  
6 potentially also in this area, but here primarily,  
7 this could be where you have the multiple lines of  
8 evidence.

9 For example, you might have for the waste  
10 package a corrosion rate of X. Waste packages are  
11 lasting for X thousands of years. There could be --  
12 as DOE has indicated, there are some particular  
13 minerals in nature that you can look at to get a sense  
14 of, does this make any sense at all? And so I think  
15 you have multiple lines of evidence.

16 I think you can do that at all the  
17 subissues, be it transport in the unsaturated zone,  
18 infiltration. There are many things that I -- but I  
19 think here is where they tell us, "Here is the result.  
20 Here is what our model is doing. And here is some  
21 analogue information. Here is some potentially  
22 experimental information, field experiments,  
23 laboratory experiments, that support the ultimate  
24 value that's coming out of your model."

25 Demonstration of compliance. Having done

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the model abstractions, and I think that's where --  
2 given you have that understanding, you think the  
3 models are appropriately integrated, there's  
4 justification, you have a sense of how uncertainty was  
5 dealt with, what your support is. I think you can  
6 easily go, then, to the demonstration of compliance.  
7 What is the final dose number?

8 And, as you know, their requirement is  
9 reasonable expectation. We want to make sure,  
10 certainly, that probability estimates for the  
11 scenarios and the consequences -- there is certainly  
12 a mathematical correctness there that we want to make  
13 sure that -- you know, that the numbers have been  
14 added up correctly.

15 Certainly, looking at parameter  
16 uncertainty and the model uncertainty, how that's  
17 manifested in the final dose number, we've looked at  
18 it at the subissue level. When you look at given --  
19 you understand how uncertainty is manifested in the  
20 subissues, do you see a dose result consistent with  
21 your understanding of that uncertainty?

22 And as Dr. Garrick pointed out, we are  
23 using -- essentially, we would use all three. The  
24 performance assessment tool would be the basis for all  
25 three performance objectives. Clearly, the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 groundwater protection is an intermediate result to  
2 the dose. You have to get a concentration.

3 Obviously, for some nuclides it's  
4 15 picocuries per liter. Other it's four millirem to  
5 the organ or the whole body. And so you have to do  
6 some manipulation with that information, but  
7 ultimately you're taking the concentration and you can  
8 feed it off into the all pathway dose assessment or  
9 into a post processor to demonstrate whether you've  
10 met the groundwater protection requirement.

11 CHAIRMAN HORNBERGER: Tim, a quick  
12 technical question.

13 MR. McCARTIN: Yes.

14 CHAIRMAN HORNBERGER: For the groundwater  
15 protection, is that the concentration with everything  
16 dissolved in 3,000-acre feet?

17 MR. McCARTIN: Yes.

18 CHAIRMAN HORNBERGER: Okay.

19 MR. McCARTIN: And, finally, I just want  
20 to get back to, well, what kinds of analyses might the  
21 staff do to support these reviews? First and  
22 foremost, I think we want our own quantitative  
23 understanding of each barrier's capability. And by  
24 that, as I mentioned before, we're looking at the  
25 capability of a barrier.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1                   Certainly, the waste package is an easy  
2                   capability to describe. While it's operating, there  
3                   are no cracks, no holes. There is no release, so it's  
4                   zero. When there's a -- however, we also have a  
5                   limited amount of water contacting the waste. We  
6                   think that's important.

7                   Slow release rates from the waste form.  
8                   These things don't release that quickly. Iodine  
9                   technetium -- one of the reasons you see that is they  
10                  have a gap fraction that is available for an  
11                  instantaneous release. It's a fairly high percentage.  
12                  I'll say two to four percent. That's a lot of release  
13                  and over a very short time period. One of the reasons  
14                  -- once again, iodine technetium show up, mobile, has  
15                  a gap fraction, high solubility.

16                  Delay of specific radionuclides due to  
17                  retardation, and I guess this is very important.  
18                  Iodine technetium -- a very, very small percentage of  
19                  the inventory is lightly retarded. But the fact that  
20                  nothing else -- you're seeing virtually none of the  
21                  other radionuclides, they're retarded here.

22                  I think we need to do some of the  
23                  calculations to get a sense of what's being retarded,  
24                  because the fact that we should not be -- well, we  
25                  want to be focused on two things. Things that give

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 high doses, but attributes of the system that result  
2 in zero doses, are also important. Just like people  
3 are concerned with the waste package, it's no releases  
4 for a long period of time.

5 The saturated and unsaturated zones have  
6 the capability to provide no releases for times  
7 sometimes much longer than the waste package for a  
8 large host of radionuclides. We want to make sure  
9 those zeroes are appropriately zeroes.

10 Certainly, we'll do sensitivity analyses.  
11 Dick and Sitakanta I thought did a good job of giving  
12 different areas we're looking at. I think the  
13 strength of the PA program is you never want to be  
14 satisfied with where you're at. I think you want to  
15 constantly look to new techniques to see if you have  
16 a better way of analyzing the problem, and I think we  
17 continue to look at different approaches.

18 Dick mentioned the neural networks. There  
19 is things that maybe there is other areas that provide  
20 analysis ways/methods to look at the problem that may  
21 be helpful, and I think we want to explore that.

22 We certainly want to be -- and we are  
23 working diligently at understanding differences  
24 between our sensitivity analysis and the DOE's.  
25 Ultimately, we are interested only in DOE's, and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that's our focus.

2 And, as you know -- and we've commented  
3 about this before -- for example, the diffusional  
4 release that DOE has, it dominates the early release  
5 for their waste package, or some of the things --  
6 there are differences in the unsaturated and the  
7 saturated zones for matrix diffusion between our  
8 different models.

9 The beauty of that is we all came to our  
10 models with a certain understanding, working through  
11 the DOE's model, and our model I think is strengthened  
12 by understanding strengths and limitations of both  
13 approaches. But, certainly, we'll do the sensitivity  
14 analyses, but you want to be mindful of -- because  
15 there are some important differences.

16 CHAIRMAN HORNBERGER: Tim, in fact, as we  
17 know, the sensitivity analyses are model-specific. So  
18 you lay your testing as the sensitivity of TPA when  
19 you do sensitivity analyses on TPA. And, certainly,  
20 it may give you some insights as to what you want to  
21 look at at the DOE case. But are you -- do you have  
22 plans to actually do sensitivity analyses on the TSPA  
23 itself? Or just try to interpret DOE's presentations?

24 MR. McCARTIN: No, we're not going to try  
25 to -- well, we certainly try to interpret their

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 presentations and ask questions, etcetera. But we do  
2 have the Goldsim model in-house, and we're --  
3 currently, Dave Esh is working on an effort to bore  
4 into that, down to the last parameter, and understand  
5 how their model is working, what the assumptions are,  
6 what the parameters are, and where -- I think in the  
7 next year we're going to move to be doing far more  
8 work with DOE's model than with ours.

9 We have a limited capability for running  
10 their model. They have a different approach than we  
11 do. If needed, I think the Department would probably  
12 be willing to do some particular simulations for us.  
13 But right now, we won't run their model, but we do  
14 have their results. And I think -- I think it will be  
15 a very interesting exercise, and I think it will help  
16 us get even more ready for reviewing their model when  
17 ultimately --

18 CHAIRMAN HORNBERGER: I guess I'm just  
19 trying to figure out at the end of the day if, in  
20 fact, the license application comes in and you have  
21 sensitivity analyses, how does this play into your  
22 review of --

23 MR. McCARTIN: Well, it's risk  
24 information. It's in a broad area of, where do we  
25 want to focus the review? We clearly -- there are --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 CHAIRMAN HORNBERGER: But your intention  
2 isn't to give DOE guidance on how the sensitivity  
3 should be done.

4 MR. McCARTIN: Oh, no. Absolutely not.  
5 No, no, no.

6 MEMBER GARRICK: I think part of what  
7 George is getting to is the chicken and egg problem  
8 you have of, on the one hand, early in the analysis  
9 identifying what's important, and on the other hand,  
10 later in the analysis, allocating the resources in  
11 accordance with that.

12 And sometimes you don't always discover  
13 what's important until late in the analysis. And so  
14 that has to be done with great care.

15 MR. McCARTIN: Yes, I would agree  
16 completely.

17 MEMBER GARRICK: Yes. And the other thing  
18 relating to the review plan is that the review plan is  
19 very specific with respect to the abstractions that  
20 you're going to consider. And I know that the whole  
21 abstraction process has been a major issue and concern  
22 of the staff.

23 I hope that the review plan has the  
24 flexibility to adjust to additional abstractions that  
25 are listed here or a restructuring of the abstractions

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that are listed here, because --

2 MR. McCARTIN: Yes. I think we have a lot  
3 of flexibility. Now, the bins are broad enough that  
4 there is a lot of information in a particular area, be  
5 it the, you know, corrosion of the waste package. I  
6 mean, you know, you'll have a bin for corrosion of the  
7 waste package. Within that, DOE has to talk to what  
8 kind of water chemistries, etcetera, that are  
9 impacting it.

10 And I think that's where the flexibility  
11 is in that we haven't pointed to any particular water  
12 chemistry they have to consider. But you're right  
13 that, have you missed something? You really want to  
14 look carefully at the FEPS analysis. What have you  
15 included? What have you not included? And why?

16 And there is a lot of work there to make  
17 sure you -- gee, now you don't think this is possible,  
18 but it could have a very big effect. And it's not a  
19 simple problem, but I think the model abstractions are  
20 broad enough that I don't know if we would need any  
21 further model abstractions.

22 But there is nothing to preclude us from  
23 taking some out, adding some in, but I think within  
24 the model abstraction there is a lot of -- I mean, on  
25 the plus side, I think from the NRC's standpoint, we

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 gave DOE the flexibility. You need to describe what  
2 you've done and defend it. That gives complete  
3 responsibility to the Department.

4 We're not going to tell you what has to be  
5 in there, but we're going to review it and --

6 MEMBER GARRICK: Yes. And the issue is  
7 the completeness.

8 MR. McCARTIN: Yes.

9 MEMBER GARRICK: Have we appropriately  
10 mapped from the process models and the analysis models  
11 that are very detailed to the TPA.

12 MR. McCARTIN: Yes, absolutely.

13 MEMBER GARRICK: And the completeness of  
14 that process is a very important part of what you're  
15 trying to do.

16 MR. McCARTIN: Yes. Yes. And that's one  
17 area where I think -- and the proof will be when and  
18 if it actually happens, so there's no guarantee that  
19 a license application is filed. But if it's filed,  
20 that's why I like the barrier description up front.

21 MEMBER GARRICK: Yes.

22 MR. McCARTIN: They provide, here is why  
23 it works. And I think at a broad level, that's where  
24 you're looking at, does this make sense? Can I think  
25 of things that could be there that would defeat that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 barrier? Here's it's capability, etcetera. And then,  
2 with that information, you go into the model  
3 abstractions with a sense of where in the Department's  
4 safety case it appears that the capability is the  
5 largest.

6 I'd like to think that, having been  
7 looking at high-level waste disposal and performance  
8 assessment for around 20 years, that at least for the  
9 model abstractions the big ticket items we have. But,  
10 you know, there is always new information potentially  
11 coming in.

12 MEMBER GARRICK: The only point of the  
13 comment is that we don't want to let the review plan  
14 bound our thinking about what we consider.

15 MR. McCARTIN: Absolutely. And that is a  
16 very good point, a good word of caution to the staff.  
17 And I think it's incumbent on us to look at what's  
18 said in the review plan and make sure that that  
19 thought is in there somewhere.

20 And maybe it needs to be explicitly stated  
21 somewhere up front, but you're right, and it's -- the  
22 review plan is to give an order so that -- of the  
23 review so that we make sure we cover all of the things  
24 we do. We need to cover and adjust the review  
25 accordingly, but you're absolutely right. Along those

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 lines, we would expect to do focuses analyses.

2 I think one of the things we've strived in  
3 our TPA code -- and, as you heard yesterday, 5.0 will  
4 be -- we're in the thinking process for that -- we  
5 tend to try to make a code that's flexible to  
6 analyzing a variety of different concepts. We have  
7 many different alternative models for ways that the  
8 waste package -- we have two waste package failure  
9 models, two different -- or three or four different  
10 models for release, except we have different ways to  
11 look at the problem.

12 I think we'll be able to -- if we have a  
13 question about an aspect of the behavior, we'll be  
14 able to do some focused analyses with the PA looking  
15 at a very specific issue. Also, we would expect  
16 process level models, that for some things you're just  
17 going to have to do a much more detailed model and  
18 see, do we agree that that process can be eliminated?

19 Seepage, non-isothermal flow, etcetera,  
20 are things where you may have to do more process-level  
21 models. And I think we have that capability and that  
22 support where we go back to the Department to ask --  
23 we need more information about this. Ultimately, in  
24 our review, that's what we're looking -- what do we  
25 need more information on? We need to support our

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 basis for that.

2 Groundwater protection standards -- we'll  
3 certainly -- as I mentioned before, it's really an  
4 intermediate result to the PA. We don't think that  
5 this adds any additional burden to the calculation.  
6 We will do it. Or the Department will have to  
7 demonstrate that. Unlikely events will not be  
8 considered, and, as I mentioned, the rulemaking to  
9 make that a more quantitative value rather than the  
10 qualitative nature of it is underway.

11 For human intrusion, a key part of the  
12 standard that we adopted is that DOE needs to  
13 determine when this will occur. We certainly have to  
14 review the DOE analysis of when the occurrence will --  
15 of the intrusion would occur.

16 And, finally, I thought this would go  
17 quicker, but I got some good questions. I don't know  
18 how much time I was given. I probably went over, but  
19 I've been accused of that before.

20 Pat felt -- he's after me. He says he may  
21 not get on when I got up, so --

22 In summary, fundamentally, Part 63, the  
23 requirements, the review, is looking at the  
24 understanding of the system behavior. That is key and  
25 foremost. We would expect to be looking at the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 technical basis for that understanding -- would be  
2 commensurate with the risk importance. And we  
3 certainly will do a variety of focused analyses to  
4 assist our review.

5 I'd be happy to answer any questions.

6 CHAIRMAN HORNBERGER: Thanks, Tim. Let's  
7 see, I have a couple of questions. Let me kick off  
8 with -- to a certain extent I guess we've covered  
9 this, and perhaps we may reach an agreement that we'll  
10 never use the conservatism word again.

11 But are you confident that you will have  
12 given or will be able to give DOE appropriate guidance  
13 on what you mean by evidence-based? Do you think that  
14 that's clear in your acceptance criteria that what  
15 you're after is enough evidence to support the case  
16 that they make?

17 MR. McCARTIN: That's a good question. I  
18 mean, the quick answer is, yes, I'd like to think that  
19 the acceptance criteria are clear enough. Having said  
20 that, though, I think the uncertainties are so  
21 different between the different subissues that there  
22 is really no simple answer.

23 That I think ultimately right now it's  
24 coming about by virtue of the agreements that we  
25 reached that I think gave the Department an idea of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 what -- where we thought support was needed further,  
2 where support was appropriate. I think we're going to  
3 have -- continue that dialogue, that prelicensing  
4 dialogue, on the agreements that I think is critical.

5 It's one of those things, the review plan  
6 can only go so far. And I think we've given it a  
7 framework, but I guess I'm not confident that the  
8 review plan could go all the way that would be needed.  
9 I think it's really sitdown conversations with the  
10 Department.

11 MR. CIOCCO: Jeff Ciocco with the NRC  
12 staff. We did add some language up front in the --  
13 it's on page 4.2-2 and 4.2-3 on conservatism. It  
14 doesn't necessarily reflect back in the acceptance  
15 criteria yet. As Tim said, this was kind of a high-  
16 level -- we want to give staff some guidance, and this  
17 was really in response to your letter on the TSPA-SR.

18 We went back and felt that we needed to  
19 address the issue. And you can read -- there's a  
20 couple of paragraphs in there, and it was kind of the  
21 basis, kind of a general framework for dealing with  
22 conservatism. But it's not -- as Tim said, it's hard  
23 to capture back in the specific acceptance criteria.  
24 And we're probably not there yet in that area, but I  
25 think we have major feedback in that area as far as

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 what we have.

2 MR. McCARTIN: Yes. I mean, that's --  
3 yes, that discussion is more along the lines of you  
4 need to be careful when you go down the conservative  
5 path, as compared to how much evidence do you need to  
6 support --

7 MR. CIOCCO: Right.

8 MR. McCARTIN: -- something. And it's  
9 more along some of the concerns the committee has had  
10 in terms of, well, you justify this approach. It's  
11 conservative. I don't have to do any more.

12 But is it truly conservative? It's  
13 conservative for maybe you're getting more water into  
14 the drifts. But depending on what modeling approach  
15 you want to look at, gee, more water could make the  
16 salt concentration on the waste package more dilute.  
17 And so it extends the lifetime of the waste package.

18 So the fact that it's -- you're saying  
19 it's conservative for water, yes, but as I know the  
20 committee has pointed out, it may not be conservative  
21 in terms of what the final dose estimate is. And  
22 there is --

23 CHAIRMAN HORNBERGER: That's a good  
24 example for my second question, which was, are you  
25 confident that even though you have these what are

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 called integrated subissues that you really are going  
2 to integrate and not be stuck in stovepipes for your  
3 analysis.

4 Your example of water changing salt  
5 concentration might be --

6 MR. McCARTIN: Sure. Yes. I believe so,  
7 but it is a challenge. There is absolutely no  
8 question about that. The reason I have confidence is  
9 over the past month or so we've had a number of what  
10 some people called brutal meetings. Brett Leslie and  
11 Chris Grossman were doing the risk ranking of the  
12 agreements, etcetera. I know they've defined it as  
13 brutal.

14 Now, they had to coordinate all of them,  
15 and maybe that's why. I found -- I attended all but  
16 one of the 14 meetings, whatever they were. They were  
17 fascinating, and they were tremendous discussions  
18 between -- with the staff, both here and at the  
19 center. And getting to just that issue, there were,  
20 I'll say -- people were encouraged and everyone took  
21 up the gauntlet appropriately.

22 If you have any stake in this issue, you  
23 need to be at this meeting. And there was a lot of  
24 discussion between -- while we divvy the work up  
25 between different KTIs, or different subissues,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1       however you want to -- there will always be some of  
2       that.

3               The cross-discussion is absolutely  
4       critical, and that -- those discussions, which will  
5       continue, I think are fostering a very high degree of  
6       integration. And I think the agreements -- although I  
7       know the agreements have taken some criticism, if  
8       there is one very, very positive thing with the  
9       agreements, I think it's people have really focused  
10      on, how does this relate to my -- and, actually, it's  
11      been a tremendous integrating tool.

12              And I think those meetings are going to  
13      continue, but I -- I think in that sense, yes, we will  
14      be able to integrate.

15              Pat, do you have --

16              MR. MACKIN: This is Pat Mackin from the  
17      center. Just one clarifying point. Each of these  
18      subissues is explored by a team, which is, by design,  
19      multidisciplinary. So that anyone, as Tim would say,  
20      that has a stake in any issue, whatever their  
21      discipline is, is involved in that team.

22              CHAIRMAN HORNBERGER: Thank you. Milt?  
23      Raymond?

24              VICE CHAIRMAN WYMER: I have one fairly  
25      detailed question, Tim. Under model abstraction, you

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 say each model abstraction uses the same five generic  
2 acceptance criteria. One of those is adequate  
3 characterization and propagation of data uncertainty,  
4 and I guess I would add to that the lack of data  
5 uncertainty.

6 (Laughter.)

7 Are you reasonably comfortable that you  
8 can, in fact, propagate the uncertainty -- the  
9 uncertainty reflected in the dose? And it seems to me  
10 that's extraordinarily difficult to do, and the same  
11 thing can be said about the abstraction or the  
12 propagation of model uncertainty. Those seem to me to  
13 be very difficult things to do, considering what you  
14 haven't had to work with.

15 MR. McCARTIN: Right. Well, certainly, in  
16 terms of -- we have techniques for the parameter  
17 uncertainty, and you can vary parameters and see what  
18 it -- how it changes dose. In terms of looking at  
19 model uncertainty, you can try different conceptual  
20 models and see what the ultimate effect on dose is.

21 But at the heart of your concern is -- at  
22 least in my opinion, is that, have you captured all of  
23 the uncertainty? Have you -- there is certainly  
24 knowledge -- you're only putting in what you know.  
25 There are certain aspects of it that, gee, what I'm

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 not certain about I may not even have in the model,  
2 etcetera.

3 VICE CHAIRMAN WYMER: How do you propagate  
4 it?

5 MR. McCARTIN: Well, I don't think you  
6 can, but I think you have to look at -- I will fall  
7 back on you have other aspects to look at to help you  
8 make your decision, and I look at the barriers  
9 ultimately. That's part of why multiple barriers are  
10 there is a recognition that this is a hard problem to  
11 quantify the uncertainty for. And we'll have this  
12 multiple barrier system, because we -- we have that  
13 uncertainty.

14 And I look at when you look at the  
15 capabilities of those barriers, you'll have a sense of  
16 what they're providing. And, once again, each of  
17 those will have some uncertainty, but it's at a lower  
18 level than the dose. I think you use that kind of  
19 information to help you make the decision.

20 VICE CHAIRMAN WYMER: I suppose I was  
21 reading that a lot more narrowly than you intended it,  
22 the criteria.

23 MR. McCARTIN: What, the --

24 VICE CHAIRMAN WYMER: The adequate  
25 characterization and propagation of data uncertainty

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 seems fairly specific.

2 MR. McCARTIN: Sure. Well, it's looking  
3 at the -- primarily, the parameter uncertainty. Have  
4 you specified the ranges for these parameters  
5 appropriately? Is it properly reflected? And do we  
6 see that all the way through the -- at the end, the  
7 dose variation is consistent with the uncertainty in  
8 these parameters, etcetera?

9 VICE CHAIRMAN WYMER: My view is that it  
10 expands explosively.

11 MEMBER GARRICK: No, no.

12 MR. McCARTIN: Hopefully not explosively.

13 CHAIRMAN HORNBERGER: John?

14 MEMBER GARRICK: I only have one question,  
15 and I only want a two-minute answer. Can you remind  
16 me, Tim -- and I should know this -- where the  $10^{-8}$   
17 per year threshold came from?

18 MR. McCARTIN: Well, that was in Part 60,  
19 and we adopted that from Part 60. And I will go back  
20 -- I can't give you the rationale off the top of my  
21 head.

22 MEMBER GARRICK: Is there a connection --  
23 is there a threshold in damage level associated with  
24 the number?

25 MR. McCARTIN: I'd have to go back to 60

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 and resurrect the basis. I can't --

2 MEMBER GARRICK: Because if there is, you  
3 know, Milt's comment is very relevant here in this  
4 whole business of what constitutes adequate safety or  
5 safety.

6 MR. McCARTIN: Well, I think there was --  
7 remember,  $10^{-8}$  was one in 10,000 over 10,000 years.

8 MEMBER GARRICK: Right.

9 MR. McCARTIN: And so I know qualitatively  
10 there was some sense of what kinds of things might  
11 happen over 10,000 years. And so it was a  $10^{-4}$   
12 probability with some --

13 MEMBER GARRICK: Yes, I know that. But it  
14 has to be related to some level of consequence.  
15 Otherwise, you're into a morass of analysis that --

16 MEMBER LEVENSON: You wouldn't use the  
17 same number for somebody breaking an arm versus  
18 killing a hundred people.

19 MEMBER GARRICK: Well, I wanted a two-  
20 minute answer, and we've already gone three.

21 (Laughter.)

22 But we can solve that problem.

23 MR. McCARTIN: Yes. I'll get back to you  
24 on that one if there is some more illuminating words  
25 in the -- back from the --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MEMBER GARRICK: Yes. Because it's a very  
2 casual statement, and yet behind the statement is a  
3 potential analyst nightmare.

4 MR. McCARTIN: Sure. Now, the other  
5 thing, 63 does give the caveat that something that  
6 isn't going to have a significant effect on the timing  
7 or magnitude of the dose does not have to be included.  
8 So we're not saying go down to  $10^{-8}$  for everything.  
9 It's just things would have to have some type of  
10 material effect.

11 CHAIRMAN HORNBERGER: Unless there is some  
12 burning question from somebody, and it has to be a  
13 short burning question -- Latif?

14 (Laughter.)

15 MR. HAMDAN: Tim, a very short question.  
16 One site attribute that DOE has cited many times, and  
17 you cited this morning, is the limited amount of water  
18 protecting the waste. And yet on Tuesday DOE told us  
19 that the amount of seepage is not important to the  
20 process. It's the humidity and the chemistry of  
21 seepage, and I believe that the TPA report essentially  
22 is coming to raise another conclusion.

23 So how -- are we going to rethink this  
24 attribute, or reword it, or --

25 MR. McCARTIN: Well, I --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. HAMDAN: -- in view of the findings?

2 MR. McCARTIN: -- I think it's still true.

3 The humidity -- the corrosion rate is sensitive to the  
4 humidity, not to the seepage. And in that context, I  
5 totally agree. However, intuitively, I have yet to be  
6 convinced that the amount of water contacting the  
7 waste doesn't have a material effect on how much waste  
8 is transported away.

9 And it does matter. It's certainly -- for  
10 something like neptunium where there is, you know, a  
11 lot of it, and it's somewhat solubility limited, the  
12 more water that contacts, the more neptunium will move  
13 away.

14 CHAIRMAN HORNBERGER: Okay. What I'd like  
15 to do, Pat and Jeff, if it's okay, is take a 15-minute  
16 break. Okay.

17 (Whereupon, the proceedings in the  
18 foregoing matter went off the record at  
19 10:20 a.m. and went back on the record at  
20 10:37 a.m.)

21 CHAIRMAN HORNBERGER: Let's reconvene the  
22 meeting. We're continuing with our presentation on  
23 the Yucca Mountain review plan, and Pat Mackin is our  
24 next speaker.

25 MR. MACKIN: Good morning. Can you hear

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 me okay? Is my mike working? All right.

2 Jeff Pohle and I are going to talk about  
3 a couple of subjects that are addressed in the Yucca  
4 Mountain review plan, because they're addressed in the  
5 regulations, that sometimes have confused people as to  
6 how they relate.

7 I'm going to discuss safety questions, and  
8 Jeff is going to discuss the performance confirmation  
9 program.

10 The issue of safety questions is one  
11 that's common to a lot of NRC regulations, and it  
12 deals with the potential that at the time of a given  
13 licensing step there are safety questions remaining.  
14 These are different from performance confirmation  
15 issues. These are areas where research and  
16 development might be required to verify the adequacy  
17 of design, for example. So, in other words, something  
18 that people are not sure of yet.

19 Since this is an area that is somewhat  
20 vague at this point, our acceptance criteria are also  
21 designed to enable us to flexibly assess a number of  
22 different situations. And these bullets here  
23 represent the acceptance criteria that are outlined in  
24 the Yucca Mountain review plan for safety questions.

25 The first one is pretty straightforward.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 It's if there are any at the time of construction  
2 authorization, have they been adequately described and  
3 identified? Has a technical basis been provided? Is  
4 it clear what the question is, and that it relates to  
5 safety or to waste isolation?

6 The second one, then, is, how has DOE  
7 proposed to address any such questions? Or what is  
8 the technical basis for their plan to resolve the  
9 question? And, again, it's kind of a little bit  
10 difficult to talk about in the abstract. There are no  
11 currently identified safety questions. That won't be  
12 determined until such time as our licensing decision  
13 and licensing review is to be made.

14 The next acceptance criterion fits in  
15 pretty well with the nature of a safety question,  
16 which is, what's the schedule for resolving it? If  
17 the Commission agrees that a safety question can  
18 remain at a particular state in licensing, that would  
19 have to be resolved by some specific time, so you  
20 could support the receipt and emplacement of waste.

21 So it's not an open-ended thing. It's  
22 something that has to be closed out at some point.

23 MEMBER GARRICK: Pat, are we talking about  
24 safety here in the same way we were talking about  
25 safety earlier?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. MACKIN: Yes.

2 MEMBER GARRICK: Okay.

3 MR. MACKIN: These questions would be  
4 related -- the important to safety or to waste  
5 isolation.

6 MEMBER GARRICK: Okay.

7 MR. MACKIN: As defined in Part 63.

8 The next one would be, if the Commission  
9 would agree to go ahead with some safety questions to  
10 be addressed, are there alternatives in the  
11 construction or the operation of the design that would  
12 have to be considered to allow for that question?

13 And, finally, and the most important, I  
14 believe, of the acceptance criteria is, if there are  
15 any such questions, the staff will need to make a  
16 recommendation, based on their overall integrated  
17 effect on the construction of the repository, whether  
18 it's appropriate to go forward with the construction  
19 authorization or not.

20 And since that decision was based on --  
21 would be based on the number and nature of any such  
22 questions, we have not attempted to lay out any  
23 specific criteria for how that judgment would be made.  
24 And, again, by its nature, this particular aspect of  
25 the review plan is focused on items that are important

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 to safety or to waste isolation. The acceptance  
2 criteria you can see are fairly generic.

3 I've been asked to give an example of what  
4 such a safety question might be, and I'll do so only  
5 with a bunch of caveats. And one is --

6 (Laughter.)

7 -- there are no such formally defined  
8 safety questions. That's a premature thing. And,  
9 therefore, what I'm going to suggest is just a what  
10 if. It's not something that's going to happen  
11 necessarily.

12 But one might be, for example, that at the  
13 time of construction authorization there are questions  
14 about the stability of the underground facility when  
15 it's constructed that cannot be resolved without  
16 further digging and making of tunnels and analyzing  
17 and mapping and measuring and things like that.

18 The Commission could consider, based on a  
19 DOE plan, for further underground excavation,  
20 monitoring, measuring, experimentation, that it would  
21 be okay to go ahead with construction while this  
22 further investigation continues into the development  
23 of the underground facility.

24 It's clearly important to safety. It's  
25 something at which the Commission might say, given the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 circumstances at the time, it's okay to proceed, given  
2 that you've given us a schedule and a plan. Of  
3 course, but there may be a license condition that they  
4 would not be allowed to go beyond some certain point.

5 Or, certainly, receiving and placement of  
6 waste couldn't take place until this question were  
7 resolved. But that is an example of the kind of thing  
8 where there is -- it's different from a performance  
9 confirmation item, where something has been used to  
10 make the safety case, and now the Department of Energy  
11 is confirming that the repository is performing in  
12 that manner. This is something where there is a  
13 question that isn't answered related to safety.

14 Does that help at all with what the nature  
15 of these things might be if there were to be any at  
16 that time?

17 And, again, this is the last bullet on my  
18 presentation is these are different things from what  
19 performance confirmation is intended to do.

20 Pending any questions, that's all I was  
21 going to say about safety questions, and Jeff Pohle is  
22 up next.

23 CHAIRMAN HORNBERGER: John?

24 MEMBER GARRICK: Yes. So these are safety  
25 questions that were not otherwise considered.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. MACKIN: I don't know if "not  
2 otherwise considered" is the full scope of it. It  
3 might also be things that were considered and  
4 addressed, but at the time of the license application  
5 were not fully answered.

6 MEMBER GARRICK: Oh, I see. But I was  
7 thinking of -- I thought I heard you say that may have  
8 come up and that they'd turn out to be outside the  
9 performance assessment, or what have you. So this is  
10 more of a degree of resolution.

11 MR. MACKIN: Right. In this case, in  
12 fact, this issue of underground stability would have  
13 to be addressed both in the preclosure safety  
14 assessment and, I assume, for the postclosure  
15 performance assessment.

16 MEMBER GARRICK: Yes. And I guess if --  
17 what it really does is allow some flexibility to deal  
18 with these problems, given that there's a long  
19 preoperational period or pre --

20 MR. MACKIN: Well, I think it becomes a  
21 really -- I don't want to speak for the staff here, of  
22 course, but I think it becomes a really tough  
23 judgment. This is not meant to be a place you can  
24 dump things, a bunch of stuff that you just haven't  
25 had time to finish. There's a lot more thought than

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that that goes into it.

2 MEMBER GARRICK: Yes, that's what I'm  
3 trying to understand.

4 MR. MACKIN: And I think a decision to  
5 allow a construction authorization with a safety  
6 question remaining would be a difficult one and a  
7 well-documented one, both by the staff and the --

8 MEMBER GARRICK: But it's not out of the  
9 question.

10 MR. MACKIN: It's not out of the question.

11 MEMBER GARRICK: Right.

12 MR. MACKIN: And my understanding and my  
13 experience is other NRC regulations or other programs  
14 also deal with these what they call unresolved safety  
15 questions.

16 MEMBER GARRICK: So it's not unique, then,  
17 to 10 CFR Part 63.

18 MR. MACKIN: Right.

19 MEMBER GARRICK: Okay.

20 CHAIRMAN HORNBERGER: More questions?  
21 Milt? Raymond?

22 Pat, this probably -- this question  
23 probably doesn't fit under this particular topic,  
24 although I'm not sure where it does fit.

25 You're probably familiar with the BRWM

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 1990 booklet "Rethinking High-Level and Disposable  
2 High-Level Waste." And in there an approach is  
3 described -- well, one of the issues is that with all  
4 of the experience we have with mining, one thing we  
5 know is that there will be surprises.

6 How do surprises in the construction phase  
7 get dealt with by the NRC?

8 MR. MACKIN: There is --

9 CHAIRMAN HORNBERGER: It's not here,  
10 right?

11 MR. MACKIN: No. There are requirements  
12 in 10 CFR Part 63. And, in fact, as I understand,  
13 there will be license conditions, if the construction  
14 authorization is granted, for the DOE to report  
15 periodically on the progress of construction and to  
16 report any -- discovery of any items that would be  
17 important to safety that were unexpected.

18 So my understanding of that is that that  
19 would be a continuing focus of not only the NRC  
20 inspection program but interaction with DOE then as a  
21 licensee during construction.

22 CHAIRMAN HORNBERGER: Yes, okay. So, I  
23 mean, what triggered that in my mind was the example  
24 you gave with all of the caveats strikes me as  
25 something that could happen without DOE anticipating

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 it ahead of time and identifying it.

2 MR. MACKIN: In this case, though, to take  
3 that example, stability of the underground facility is  
4 an item of focus both by DOE and the staff.

5 CHAIRMAN HORNBERGER: No, I realize that.  
6 But, again, for your example to make sense, it would  
7 be something that might be anticipated that would be  
8 different with the rock in the proposed repository  
9 area versus the experience otherwise, and --

10 MR. MACKIN: The part of the regulation  
11 that deals with that I believe uses the term  
12 "unexpected conditions." Is that correct, Tim?

13 MR. MACKIN: Yes. Yes, 63.32 talks about  
14 conditions for construction. It gets into just the  
15 things Pat is talking about. I mean, there is a  
16 vehicle for DOE to update things, requirements of when  
17 they have to report things to us, and schedules,  
18 depending on what occurs.

19 CHAIRMAN HORNBERGER: Okay. Thank you.

20 MR. MACKIN: Thank you.

21 Jeff?

22 MR. POHLE: Can everybody hear me okay?  
23 Microphone working? All right. Is that any better?

24 Performance confirmation. There are only  
25 three slides on this topic, and these slides would be

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 suitable for giving an overview of how Part 63 is set  
2 up, because it's pretty much identical with the  
3 organization of the section in the review plan that  
4 deals with performance confirmation.

5 The first slide is essentially some  
6 background, straight out of the rule, the test  
7 experiments and analysis used to evaluate adequacy of  
8 information. And this particular requirement is  
9 unique to the high-level waste program. It's kind of  
10 a first of a kind.

11 And, basically, it was done in recognition  
12 of the uncertainties that exist in these long time  
13 periods that we're dealing with with the geologic  
14 repository. And, fundamentally, that the performance  
15 confirmation is intended to focus on natural and  
16 engineered -- here I call it systems and components --  
17 you could interchange the word "barriers" in here --  
18 that are important to performance.

19 This is like -- the program is essentially  
20 a confidence builder, somewhat similar like we have a  
21 requirement for multiple barriers. In addition to  
22 that, even though much work has been done in  
23 characterizing the site and designing the repository,  
24 certain testing and monitoring will be required all  
25 through the other steps of the licensing process all

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the way until permanent closure.

2 But the focus -- our intended focus would  
3 be on the barriers, and then that is all laid out in  
4 the acceptance criteria.

5 Now, the Subpart F of Part 63, which is  
6 the performance confirmation program, is -- and the  
7 review plan -- is laid out basically in the four bins.  
8 There are four main requirements. One is the general  
9 requirements, then dealing with geotechnical and  
10 design parameters, design testing, and on the next  
11 slide deals with the waste package. And most of these  
12 ticks under here are basically items in the  
13 regulation.

14 Now, these four items represent the areas  
15 of review, so the review plan will be set up for each  
16 area of review. There will be review methods and  
17 acceptance criteria, and ultimately leading to the  
18 final determination.

19 Now, at this point, when one starts to  
20 review the performance confirmation program, Tim  
21 earlier today in the section of the postclosure  
22 performance called system description and multiple  
23 barriers. Tim basically said, "While this is  
24 something we would want to read first to get the broad  
25 overview of the safety case, presumably DOE would

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 write it last."

2 Well, now, when we're at this point, this  
3 is something we would read last and it would probably  
4 really be written last on DOE's part, because it  
5 should fall down from the safety case, the performance  
6 assessment, leaving you to develop what components of  
7 the barriers would be included in the performance  
8 confirmation program for continued monitoring and  
9 testing during construction and operation.

10 A couple of points to highlight. A couple  
11 of sentences here right out of the rule, conditions  
12 are within limits assumed in the license application.  
13 Natural and engineered barriers are functioning as  
14 intended and expected.

15 We would expect the rule of common sense  
16 to apply. In the past, some concerns about these  
17 particular sentences in the rule were brought to my  
18 attention. Well, what does that mean? And let me  
19 give an example.

20 Let's say in performance assessment for --  
21 this is purely hypothetical. There is really no need  
22 -- we have evidence. We know that, let's say,  
23 groundwater would flow fast to the unsaturated zone.  
24 Let's say hundreds of years. So in a performance  
25 assessment, it may not be necessary to include that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 time. We could assume an instantaneous release to the  
2 water table.

3 Well, in reading Part 63, it would not be  
4 our expectation that DOE would have to go out and  
5 demonstrate that the travel time is zero. Is that  
6 what was used in the PA? No. Common sense says you  
7 may go back and continue to evaluate whether the  
8 evidence, i.e. short travel times, that you use to  
9 make that assumption in your performance assessment is  
10 adequate. Okay? That's kind of how it would work.

11 MEMBER GARRICK: Before you move that  
12 slide, will you say a few things about the tick that  
13 talks about "includes in situ monitoring and in situ  
14 experiments in laboratory and field testing"?

15 MR. POHLE: Right. That's a requirement  
16 in the regulation that doesn't prescribe exactly what,  
17 but merely that the program shall be composed of --  
18 shall include in situ monitoring, in situ experiments,  
19 that's in place in laboratory field testing in  
20 general.

21 MEMBER GARRICK: There's a lot of emphasis  
22 on the barriers. But that's -- well, that's why I  
23 picked on that one, but that doesn't exclude a  
24 monitoring program that is heavily oriented towards  
25 phenomenological issues. That's what the laboratory

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 and field testing --

2 MR. POHLE: Yes. There would be no intent  
3 here to be exclusionary.

4 MEMBER GARRICK: Pardon?

5 MR. POHLE: We would have no intent here  
6 to --

7 MEMBER GARRICK: Okay. What I was getting  
8 at is, in WIP, for example, it's very important to  
9 measure certain things. It's a different natural  
10 setting to be sure, and the time constants are very  
11 much different. But you want to know about thing like  
12 humidity and creep rate and closure conditions and  
13 slumping off the rooms, and what have you.

14 And, of course, the barriers there are  
15 much simpler, and it's not the issue that it is here.  
16 But the emphasis there is more on process measures and  
17 process confirmation than it is on hardware, for  
18 example. And I just wanted to be sure that I  
19 understood that the processes are also a part of this.

20 MR. POHLE: Right. Some months ago there  
21 was -- DOE had a workshop on performance confirmation,  
22 and I think the question arose, as an example, what  
23 about climatology? Not that one would need to have a  
24 specific program, but this type of thing should -- the  
25 experts in the project should just be up on the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 literature should something arise that would need to  
2 be factored in to an update of a performance  
3 assessment.

4 And we -- you know, the regulation would  
5 not preclude that. So there are lots of processes  
6 that could come into play.

7 MEMBER LEVENSON: I guess I've got a  
8 little problem with the example you gave. They use  
9 zero time. You say they don't have to prove it's zero  
10 time, but you would expect them to periodically assess  
11 the data on which the zero time is based. And I don't  
12 understand why you have such a requirement.

13 MR. POHLE: No, there is a -- there is  
14 two. And in the acceptance criteria in a review plan  
15 there are two items that are always next to each  
16 other. One is that those things you want to include  
17 in a performance confirmation are important to  
18 performance. And, two, if there are things that are  
19 important to performance that you are not going to  
20 include in the program, you need to give us the  
21 rationale why.

22 Maybe it's the existing information gives  
23 -- there's a consensus that it's of sufficient  
24 certainty nothing more needs to be done would be  
25 potentially basis for not continuing work on it.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Okay? So that, in a sense, I try to deal with that  
2 hypothetically when I work the review plan. Some  
3 things may be important but not be included in the  
4 program.

5 Someone could make that case to us or that  
6 argument to us. How would I deal with that argument?  
7 And what would my basis be for saying that's  
8 acceptable or not?

9 MEMBER LEVENSON: Do you mean you would  
10 expect that people would have to defend the assumption  
11 that there is zero retention or delay?

12 MR. POHLE: No. That they merely  
13 understood how the unsaturated zone would function.  
14 And that would be the basis for deciding how to deal  
15 with that in the performance assessment.

16 MEMBER LEVENSON: I'm not --

17 MR. POHLE: But it may not be necessary to  
18 do that if the knowledge was sufficient.

19 MEMBER LEVENSON: If it's something I'm  
20 not going to take credit for, you want me to  
21 essentially prove that it's okay to ignore what might  
22 be conservative?

23 MR. POHLE: Well, that wasn't the intent  
24 of that example. It was merely to show that --

25 MEMBER LEVENSON: Well, that's the example

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 you picked.

2 MR. POHLE: Well --

3 (Laughter.)

4 -- but it was in the context of our  
5 functioning as intended and expected, not as an  
6 example of what's important to performance.

7 VICE CHAIRMAN WYMER: I suppose it's  
8 implicit in this that if the actual conditions are not  
9 open to limits assumed with the license application,  
10 you shut the thing down. Otherwise, you wouldn't --  
11 there's no sense doing the performance confirmation.

12 MR. POHLE: That's always the potential.  
13 Retrievability is always an option, right until the  
14 time of permanent closure.

15 MEMBER LEVENSON: I hope you appreciate  
16 that my question was stimulated by Commissioner  
17 McGaffigan's questions.

18 MR. POHLE: In a sense, retrievability  
19 would be a performance requirement in a broad sense  
20 that would be considered in performance confirmation.  
21 Like the previous example, you start construction on  
22 the ground and you -- something comes up, you either  
23 have to change the design so that the waste is  
24 retrievable, or, if that's not possible, it's  
25 irretrievable, you've reached that point where the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 rule requires retrievability, you'd have to deal with  
2 it.

3 Now, included under the general  
4 requirements, the program is going to have to deal  
5 with a bunch of administrative procedures, and now  
6 you're getting into reporting requirements which will  
7 have to relate to other parts of Part 63. You learn  
8 something that's beyond some acceptable limit that  
9 could require DOE to go into some design control  
10 process and make a decision.

11 Does a design change need to be made? And  
12 if it rises to some certain level or -- that would  
13 initiate reporting requirements to the NRC to get  
14 involved and possibly amendments to the license or  
15 construction authorization.

16 VICE CHAIRMAN WYMER: On the next-to-the-  
17 last thing on your slide, the backfill question in  
18 compaction.

19 MR. POHLE: That's if backfill is used.

20 VICE CHAIRMAN WYMER: If it's used.

21 MR. POHLE: That's in the rule. In other  
22 words, if backfill is used, it's actually in the rule.

23 And the last bin is the last requirement  
24 in Subpart F that deals with monitoring and testing of  
25 waste packages, and these are requirements in the rule

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 -- representative environment, laboratories are  
2 focused on internals, and it continues up until the  
3 time from permanent closure.

4 And so all of the review methods and  
5 acceptance criteria would be related back to the  
6 specific requirements in Subpart F.

7 VICE CHAIRMAN WYMER: Is there a reporting  
8 requirement to the NRC on these performance  
9 confirmation studies?

10 MR. POHLE: My expectation would be that  
11 the procedures laid out or referenced in the  
12 performance confirmation plan would reference the  
13 other parts of Part 63 that specify what the reporting  
14 requirements are for all --

15 VICE CHAIRMAN WYMER: Okay.

16 MR. POHLE: -- things that arise.

17 VICE CHAIRMAN WYMER: Okay.

18 MEMBER LEVENSON: Would you think that  
19 this monitoring and testing equipment might be  
20 categorized as important to safety?

21 MR. POHLE: Could you explain that  
22 further? The monitoring and testing equipment?

23 MEMBER LEVENSON: Well, you're going to do  
24 monitoring and testing. That's going to require  
25 equipment. Would you consider that equipment

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 important to safety?

2 The context of the question -- the next  
3 question is going to be that the review plan requires  
4 that stuff that's important to safety -- this is the  
5 exact wording -- requires it to perform for the entire  
6 life of the facility without any remedial action.  
7 They don't have to maintain it, repair it, or do  
8 anything.

9 MR. POHLE: Well, I suppose there would be  
10 two aspects of that, both the preclosure and the  
11 postclosure. I don't think the postclosure would be  
12 germane in terms of functioning, because the program  
13 would terminate at permanent closure.

14 As to preclosure, perhaps, but I -- the  
15 one -- the only related requirement in the rule would  
16 be that the repository should be designed to maintain  
17 the retrievability option. And that's in the post --  
18 preclosure requirements section.

19 Now, that being, in a sense, a design  
20 requirement would seem to me logical that any design  
21 requirement would have to be run through the safety  
22 questions, or whatever safety analysis, what is done.  
23 Now, where one goes from there, I don't know.

24 MR. MACKIN: Excuse me. Could I ask a  
25 question? When you say -- where are you quoting from

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 saying that equipment must operate for the lifetime?

2 MEMBER LEVENSON: Well, in the version  
3 that I have, that's on page 4.1 -- Section 4.1,  
4 page 57. In the bound version the pages are slightly  
5 different, so it might be 56 or 58.

6 MR. MACKIN: Because the administrative  
7 and programmatic requirements that are addressed in  
8 the review plan specifically address the maintenance  
9 programs, testing programs, monitoring programs, for  
10 equipment important to safety. I'll have to read  
11 that, but there is certainly no intent that systems  
12 important to safety don't require maintenance.

13 MR. McCARTIN: Jeff, I guess if I could  
14 add one thing, in terms of important to safety, it's  
15 important to meeting those requirements. The way I  
16 would read the rule, it doesn't say "and also to  
17 confirm." So I think it isn't necessarily -- the  
18 performance confirmation program doesn't necessarily  
19 become important to safety. I mean, we can look at it  
20 closer, but it -- just because you're doing confirming  
21 of, say, the waste package, that confirmation I don't  
22 think just becomes important to safety by definition.  
23 At least --

24 MR. POHLE: I would say a context, though,  
25 of -- it's an active program. People are doing things

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that if that comes into play -- you know, worker  
2 safety, in that environment --

3 MR. McCARTIN: Oh, worker safety. sure.

4 MR. POHLE: -- that will have to be dealt  
5 with.

6 MR. McCARTIN: Yes.

7 CHAIRMAN HORNBERGER: Other questions for  
8 Jeff? Jeff, I guess on this slide you have it as well  
9 performance -- well, no, okay. It was on a previous  
10 slide. Oh, no, there, the very last one. Monitoring  
11 and testing will continue up until the time of  
12 permanent closure. Presumably, this doesn't preclude  
13 monitoring postclosure.

14 MR. POHLE: No. But I would not put that  
15 in the performance confirmation chapter.

16 CHAIRMAN HORNBERGER: No, no. That's  
17 right. It wouldn't be in the performance  
18 confirmation. Right, I agree.

19 But I guess the questions that we saw  
20 earlier this morning I think -- I asked Jeff a  
21 question that looks like there is a requirement for  
22 postclosure monitoring, and it would seem to me -- it  
23 strikes me that somehow there must be at least a  
24 recognition that the two might not be disjunct.

25 MR. POHLE: Well, I mean, fundamentally,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 I don't think the postclosure part has been  
2 necessarily thought through beyond permanent markers.  
3 Did that come out of NWPA? Post-dating or original  
4 Part 60?

5 MR. McCARTIN: I might it might have.  
6 But, I mean, we certainly have a requirement that DOE  
7 has to have a plan for post-permanent closure  
8 monitoring. That plan could be here's -- we're going  
9 to continue these types of things we have been doing  
10 under performance confirmation.

11 But Jeff is correct. We wouldn't do it  
12 under performance confirmation. It's a different  
13 program. We have left that right now very flexible  
14 for just the reason that post-permanent closure  
15 monitoring is probably a minimum of 100 years from  
16 now, and it would be somewhat folly to try to put  
17 anything other than a very general requirement that  
18 DOE needs to plan for this.

19 MEMBER GARRICK: But it still could be  
20 considered performance confirmation or performance  
21 monitoring. After all, a performance assessment is --

22 MR. McCARTIN: Well, in philosophy,  
23 philosophical terms, yes, you could. But because the  
24 rule has a very particular purpose for performance  
25 confirmation which goes to closure and stops --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. POHLE: The amendment for permanent  
2 closure.

3 MR. McCARTIN: Yes.

4 MR. POHLE: The last update of the license  
5 application and performance assessment.

6 MR. McCARTIN: Yes.

7 MR. POHLE: And I guess I could have  
8 mentioned earlier under the plethora of administrative  
9 parts that will have to be dealt with, the changes of  
10 the performance confirmation program in progress, or  
11 procedures will have to be developed and incorporated  
12 into the plan and reviewed dealing with that, tests  
13 terminate, new tests could start, the thing would be  
14 a living type of a program, I'm sure.

15 MEMBER GARRICK: But I think performance  
16 monitoring, if we want to call it, rather than  
17 performance confirmation for postclosure, we certainly  
18 don't want to restrict our thought processes to  
19 markers.

20 MR. POHLE: No. I know we have a zero  
21 restriction. I mean, there's --

22 MEMBER GARRICK: Right.

23 CHAIRMAN HORNBERGER: One of the things  
24 that occurs to me, and the reason that I don't see how  
25 this can be totally disjunct, is that if you were to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 treat it that way, then performance confirmation --  
2 everything ends, you know, at the end of a -- at  
3 closure.

4 But by the same token, you have this  
5 requirement for a plan. Now, if the plan, then, comes  
6 forward to have instruments, in situ monitoring, and  
7 nobody has done the testing that would give some  
8 confidence that the instruments could perform in a  
9 radiation field, what would the plan mean?

10 MR. POHLE: I agree.

11 CHAIRMAN HORNBERGER: I mean, I'm not  
12 suggesting that that would --

13 MR. POHLE: It would be difficult enough  
14 just up until the time of permanent closure.

15 CHAIRMAN HORNBERGER: Absolutely.

16 MR. POHLE: Much less at some unspecified  
17 time period beyond that. I mean --

18 CHAIRMAN HORNBERGER: I mean, on the other  
19 hand, if the postclosure monitoring is markers and  
20 biennial sampling of wells in Nye County -- other  
21 questions?

22 MR. McCARTIN: I guess in that sense, I  
23 mean, there is a recognition that your ability to  
24 retrieve is going to go away. I mean, that's the  
25 concept of closing it, and so the post-permanent

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 closure monitoring is more -- I don't -- it's  
2 confirming a part of the repository, but it could be  
3 very simple that, are there releases occurring?  
4 Period. That --

5 CHAIRMAN HORNBERGER: But the releases  
6 where, Tim?

7 MR. McCARTIN: Well, yes, it might be the  
8 saturated zone.

9 MR. POHLE: Well, there's no more decision  
10 points even in the regulation beyond permanent  
11 closure.

12 MEMBER GARRICK: According to our former  
13 member, who was a mining engineer, he says the option  
14 to retrieve never goes away.

15 (Laughter.)

16 MR. POHLE: Well said.

17 CHAIRMAN HORNBERGER: Other questions or  
18 comments? No?

19 Okay. Thank you, Jeff.

20 We take it that you're a Larry Campbell  
21 stand-in, Pat?

22 MR. MACKIN: Right. I have been asked to  
23 present this information for Larry Campbell, and I am  
24 not qualified to do so.

25 (Laughter.)

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 CHAIRMAN HORNBERGER: Your presentation  
2 has been quality assured?

3 MR. MACKIN: Yes.

4 (Laughter.)

5 When we started preparing the Yucca  
6 Mountain review plan section dealing with quality  
7 assurance, we had somewhat of a dilemma because the  
8 question was, how do you make it risk-informed,  
9 performance-based? And so what we did was -- what  
10 Larry Campbell did was to say, "We have to be ready to  
11 both evaluate a non-graded QA program and a graded QA  
12 program."

13 So the Yucca Mountain review plan needs to  
14 be flexible enough to deal with whatever DOE sends to  
15 us in any license application.

16 And then, as I say on the viewgraph, in a  
17 non-graded program everything would be afforded the  
18 same quality controls. In a graded QA program, you  
19 could vary the level of quality controls, varied based  
20 upon the significance of a structure, system, or  
21 component to safety or to waste isolation. And that  
22 is one way in which risk significance comes into the  
23 QA portion of the Yucca Mountain review plan.

24 One of the things that the Yucca Mountain  
25 review plan requires is that you read through what

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 will be an interface between the quality assurance  
2 staff and the other technical reviewers for the  
3 purpose of making sure that the assessments of the  
4 degree of importance to safety are appropriate and  
5 that the appropriate level of controls are applied.

6 In going back to Banad's presentation  
7 earlier this morning, there is what we believe is a  
8 risk-informed process that identifies structure,  
9 systems, and components important to safety. And that  
10 would be the basis for what goes on the Q list, what  
11 items fall under the QA program.

12 And if DOE applies such a graded QA  
13 system, one of the things the staff would review is  
14 the criteria they use to determine how they graded the  
15 application of the QA requirements.

16 The last two viewgraphs just show the  
17 areas that the QA program envelopes. In 10 CFR  
18 Part 60, in Appendix B -- 10 CFR Part 50, Appendix B,  
19 QA program, was called into play. In Part 63, we have  
20 actually reproduced the language necessary for the  
21 entire QA program, and it is basically a 10 CFR  
22 Part 50 Appendix B QA program, with a couple of minor  
23 changes that are shown as the last four items on the  
24 last viewgraph.

25 Those are areas where quality programs

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 ought to be employed, which are somewhat unique to a  
2 high-level waste repository. So criteria have been  
3 added for those four areas.

4 Other than that, the approach is similar  
5 to 10 CFR Part 50, Appendix B, and it acknowledges  
6 that the staff will evaluate any graded program that  
7 DOE elects to execute and the criteria they use for  
8 that program.

9 Subject to your questions, that's all we  
10 had to say on QA.

11 CHAIRMAN HORNBERGER: Thanks very much,  
12 Pat.

13 Questions for Pat?

14 MEMBER GARRICK: Yes. I'm surprised that  
15 -- maybe I'm not. I am familiar with 10 CFR 50,  
16 Appendix A, Appendix B. I'm surprised that a quality  
17 program that was designed for systems that were  
18 99 percent hardware and mostly active systems would  
19 have as much correlation with the kind of problems  
20 we're dealing with at Yucca Mountain to be able to  
21 adopt it pretty much in its whole form. And I guess  
22 it's because the QA procedures are at a pretty high  
23 level and very process-oriented.

24 MR. MACKIN: Well, I think also there are  
25 aspects such as fabrication of the disposal

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 containers, the construction of the surface facility,  
2 the equipment that will be used to emplace waste, all  
3 of those things are subject to standard QA controls.

4 Plus, things like documenting the  
5 geotechnical parameters, mapping the geology of the  
6 underground facility. How do you control that  
7 documentation? Are your instruments calibrated? All  
8 those kinds of things. Actually, there is a great  
9 deal of similarity.

10 MEMBER GARRICK: Well, in the preclosure  
11 phase, and then in the emplacement phase, but with  
12 most of the safety analysis effort being in the  
13 postclosure phase, that connection is a little more  
14 subtle.

15 MR. MACKIN: I really don't want to get in  
16 too much trouble with Larry. But I think the way he  
17 sees that is -- in writing this is that the engineered  
18 barriers and the documentation and the justification  
19 of the natural barriers that are important to waste  
20 isolation all needs to be done under a quality  
21 program.

22 Similarly, the development and use of  
23 computer codes, tracing them, validating them, all --  
24 as it applies to postclosure safety, all needs to be  
25 under the umbrella of quality programs.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1                   MEMBER GARRICK:     Let me ask Tim a  
2 question. Does the quality assurance program have any  
3 impact, or is it accounted for in any way in your  
4 waste package defects model? I mean, because that's  
5 a very important contributor to the near-term  
6 performance.

7                   MR. McCARTIN:   Well, in an indirect way,  
8 I would say yes. But if you're talking about the TPA  
9 code --

10                  MEMBER GARRICK:   Right.

11                  MR. McCARTIN:   -- what was done there was  
12 they looked at, as best they could, some similar  
13 manufacturing types of efforts, which certainly employ  
14 some type of QA program to get a rate.

15                  We have never touted ours as, "This is the  
16 way DOE needs to go." We have, I don't think, any  
17 problems with reviewing what DOE is doing in terms of  
18 QA for the waste package in deriving a defective that  
19 could be different than what we're using.

20                  We did it in a very quick qualitative  
21 sense for our code. But, you know, the burden isn't  
22 really on ours, and so we haven't gone back to relook  
23 at that. We certainly have seen what DOE has done,  
24 and I think it is -- you know, there could be a much  
25 higher level of quality assurance applied to the waste

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 package than was in our sort of generic look.

2 And so it would be appropriate, but we  
3 would -- you know, we aren't -- we have not tried to  
4 cast our, you know, I think it's a tenth of one  
5 percent to one percent, or a tenth of a percent to a  
6 hundredth of a percent as the number. But it was  
7 something that --

8 MEMBER GARRICK: Yes. It just seems that  
9 this is something we should be able to get a pretty  
10 good handle on. And this whole juvenile failure  
11 issue, that's not --

12 MR. McCARTIN: Yes, absolutely.

13 MEMBER GARRICK: -- that's not a long-term  
14 problem.

15 MR. McCARTIN: Right, right. And I would  
16 suspect that DOE will carry that forward in terms of  
17 their QA and what number they can support in the  
18 license application.

19 MEMBER LEVENSON: I've got a slightly  
20 different question, based on the statement you just  
21 made. And that is, how do you apply QA and validate  
22 codes for volcanism, seismology, climatology,  
23 etcetera, going out 10,000 years? Is that a paper  
24 exercise, expending a lot of effort?

25 (Laughter.)

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 How do you do that?

2 MR. MACKIN: In fact, there are -- the NRC  
3 has published guidance on the qualification of  
4 software, and --

5 MEMBER LEVENSON: But there's a difference  
6 between software that you can experimentally check.

7 MR. McCARTIN: Yes. If I could, you are  
8 correct. I mean, part of it is that verification, and  
9 some of the simple tests I know you've pointed to,  
10 does the code -- is there a mass balance? And you're  
11 certainly wanting to see some quality assurance for  
12 the code is doing what I intended it to do.

13 Now, that's the verification. There is a  
14 validation aspect to it. You also have to do -- you  
15 need to do something as you've seen with our  
16 regulations to justify that, indeed, this appears to  
17 be a reasonable representation. And there are limits.

18 There is -- and I don't think there's  
19 anywhere in our regulation we're asking the Department  
20 to do the impossible. But there needs to be some  
21 evidence, some support, for why you have adopted this  
22 approach. And you need do that, and it's -- once  
23 again, it's a sliding scale.

24 MEMBER LEVENSON: This might be a good  
25 place to apply graded --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. PATRICK: Dr. Hornberger?

2 CHAIRMAN HORNBERGER: Yes, Wes.

3 MR. PATRICK: Wes Patrick here in San  
4 Antonio. If I could add just one thing to Tim and  
5 Pat's comments. This is an area where we feel very  
6 strongly DOE can use natural analogues of both  
7 existing systems and ancient systems and, to a degree,  
8 Mr. Levenson, do some validation.

9 We've tried some of that ourselves to see  
10 what the limits are, to make sure that we're not  
11 requesting something that isn't possible to do. Two  
12 very good areas are with regard to structural geology.  
13 We have looked at analogue fields to get an idea of  
14 whether there is a way to get support for how much  
15 intrusive volcanism is -- or, I'm sorry, intrusive  
16 igneous activity is associated with extrusive  
17 volcanism.

18 I've also looked at analogue sites in  
19 terms of how the ash is distributed from volcanoes  
20 that are in the same relative energy of eruption.

21 In a third area, similar kinds of things  
22 have been done with regard to natural analogues for  
23 the dissolution of waste forms. And I'd like to note  
24 in that regard that the Department of Energy is  
25 currently looking at reoccupying the research site

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that NRC used at Pena Blanca, Mexico, to try to get  
2 some additional information in that regard.

3 It's not perfect, Mr. Levenson, but I  
4 think it really is -- gives -- I would think helps  
5 give a stronger foundation for those models.

6 MEMBER LEVENSON: You unfortunately used  
7 a word which triggered a response, and that is you  
8 said it's -- you're not asking for the impossible.  
9 And since I'm sensitive to questions from  
10 Commissioners, and we just had our experience  
11 yesterday, I'd have to say that our objective is not  
12 to ask for everything that's possible. Our objective  
13 is to only ask for what's essential.

14 MR. PATRICK: I don't disagree with that.

15 CHAIRMAN HORNBERGER: Other questions?  
16 Raymond? Staff?

17 Thanks very much, Pat.

18 Jeff is going to tell us some -- a few  
19 concluding comments, but also tell us a bit about  
20 schedules.

21 MR. CIOCCO: Right. We just concluded our  
22 formal presentation. We've covered about --

23 CHAIRMAN HORNBERGER: You're going to have  
24 to use a microphone, Jeff.

25 MR. CIOCCO: Oh, I'm sorry. I thought

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 this was on. Is it on? Okay. I can put it on my  
2 chin. Thank you.

3 Okay. I did want to clarify one question  
4 or one response I gave as far as the acceptance review  
5 that Dr. Hornberger asked. And I went back to  
6 Section 21, and it's clearly the intent and the  
7 expectation that within the 90 days we will provide  
8 the results to the Department of Energy of an  
9 acceptance review, including any requests for  
10 additional information. It will not be on the  
11 critical path, and I think I misspoke earlier on that  
12 point.

13 As far as the schedule, we certainly want  
14 to leverage your knowledge and expertise as much as we  
15 can in your review and commenting on the Yucca  
16 Mountain review plan. And I kind of briefly earlier  
17 covered what our schedule is, and just let me say it  
18 again. We're currently printing up the NUREG,  
19 NUREG 1804. They will probably finish distribution  
20 this week, get all of their mailing -- the big mailing  
21 campaign done.

22 The NUREG will be published, up on the  
23 website. There's a nice site on the new external web  
24 now for NUREGs -- NUREGs for comment. Once it's up on  
25 the web, which will probably be later this week or

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 early next week, we'll issue a Federal Register notice  
2 for a 90-day notice of availability and request for  
3 public comments.

4 And I expect that to be dated around  
5 April 1st. So we'll start a 90-day -- minimum 90-day  
6 public comment period. So, and that's a 90 working  
7 day. So April, May, and June. And we expect some  
8 time probably in the middle of the public comment  
9 period to go out and conduct public meetings in and  
10 around Las Vegas, possibly the week of May 20th.  
11 We're not exactly sure.

12 So that will leave the close of the public  
13 comment period probably about the end of June. It  
14 will take some time, depending on how many public  
15 comments we get, to do our response to comments, do an  
16 addendum to the NUREG, and that whole -- we will then  
17 begin a finalized Revision 2, and then we need to send  
18 that back up to the Commission. So some time this  
19 fall or early winter we expect to do that.

20 So I'm just -- I'm trying to give you some  
21 of the -- you know, an idea of what kind of timeframe  
22 that the ACNW may be looking at as far as interactions  
23 with staff to answer any of your questions and to get  
24 as much feedback as we can before you write your  
25 letter.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 I know Dr. Garrick has an interest in  
2 talking about the preclosure safety assessment ISA.  
3 He wants to, you know, talk about this with some of  
4 the staff, getting into some of the technical issues.  
5 And in any areas that you would like to do that, we  
6 certainly can do that now. We have a public document.

7 So that's really all that I wanted to  
8 conclude with. If you have any questions for any of  
9 us here, general questions or specific to the review  
10 plan, feel free to ask.

11 CHAIRMAN HORNBERGER: I have one to start  
12 with anyway. I just want to make sure that I'm  
13 totally clear on this. I gather from all of the  
14 presentations that your position is that your -- all  
15 of your acceptance criteria are flexible. That is,  
16 they are not prescriptive. Is that your position?

17 MR. CIOCCO: Well, they could be. That  
18 was the intent. And we were given, you know,  
19 direction from the Commission to make acceptance  
20 criteria performance-based.

21 CHAIRMAN HORNBERGER: Right.

22 MR. CIOCCO: Give the potential licensee  
23 performance criteria, and they have the flexibility in  
24 meeting that criteria. And so that certainly was the  
25 intention.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1                   Now, there are some programs that are very  
2 specific in the general information and physical  
3 protection requirements in Part 73. There is not a  
4 whole lot of flexibility. If you read the rule in  
5 Part 73, there are certain setback distances. You  
6 know, there's a lot of very specific areas. But in  
7 preclosure and postclosure, that was certainly the  
8 intent, yes.

9                   CHAIRMAN HORNBERGER:       Okay.       Other  
10 questions?   John?

11                  MEMBER GARRICK:     Jeff, just so that I  
12 don't deal with it elsewhere, if it's irrelevant or a  
13 nonsensical issue, but one of the things that I kind  
14 of looked for in this report was maybe some aids or  
15 graphics that would add clarity to how this process  
16 works. Is that something that's coming later in  
17 guidance documents, or what have you? Or is it even  
18 something that was considered?

19                  Again, I'm thinking of I think from the  
20 standpoint of understanding how this process works,  
21 after you read about 200 pages and it kind of repeats  
22 itself with -- just with respect to different types of  
23 issues, you sort of see a rhythm and a structure that  
24 probably could be communicated very effectively in a  
25 well-designed activity network or some such thing.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Did you consider using any graphics in  
2 this?

3 MR. CIOCCO: Yes, we did. Are you  
4 speaking on the postclosure --

5 MEMBER GARRICK: Yes. I'm speaking  
6 primarily of the postclosure.

7 MR. CIOCCO: Yes. I think we tried to do  
8 as much narratively as we could up front in kind of  
9 laying out the review process. And I know I've talked  
10 some with our public outreach people recently, and  
11 we're, you know, thinking about ways of communicating  
12 the performance assessment process with some visual  
13 graphics, how the review process would work at the  
14 public meetings, and there's certainly a possibility  
15 to put those in here.

16 There was no restrictions on what we  
17 could --

18 MEMBER GARRICK: Okay. That was really  
19 my --

20 MR. CIOCCO: -- as far as I'm aware. I  
21 mean, we have the flexibility.

22 MEMBER GARRICK: But there's no  
23 fundamental reason for why they were not included.

24 MR. CIOCCO: No.

25 MEMBER GARRICK: Yes.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. CIOCCO: No. No, it's certainly -- I  
2 mean, if it's an aid to the reviewer, it -- if it's  
3 helpful to the reviewer and to the public to  
4 understand our process, then it's a good idea to put  
5 in there.

6 MEMBER GARRICK: Thank you.

7 CHAIRMAN HORNBERGER: I think perhaps  
8 particularly the public is our thinking. But as John  
9 said, a picture with a thousand words isn't  
10 necessarily the direction we want to go.

11 (Laughter.)

12 Milt?

13 MEMBER LEVENSON: I've got a little bit of  
14 a general question. It's fairly clear, I think, that  
15 some of this was put together using reactor experience  
16 and background, because, for instance, in the section  
17 on important to safety there are 10 references. Seven  
18 of them are basically things coming from reactors.

19 How extensive or what kind of a review was  
20 done to make sure that since this is a completely  
21 different facility, completely different time  
22 constants, completely different risks, that things  
23 that are relevant to reactors and not to this facility  
24 were not transferred over.

25 And I'll give you one example that I think

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 maybe got through your network if you had one. One of  
2 the requirements is that you minimize the mass of  
3 shielding materials subject to neutron activation.  
4 That's a very good one in the reactor. I don't know  
5 what its significance is in this system.

6 MR. CIOCCO: That's a good point.

7 MEMBER LEVENSON: Lots of requirements  
8 were imposed that really aren't relevant to this  
9 facility.

10 MR. JAGANNATH: Banad Jagannath, staff.  
11 In the preclosure part, the fact that we had no time  
12 to develop any of our own guidance, they are borrowed  
13 heavily from what is existing, with a clear caveat  
14 that had to be applied as appropriate for the cases  
15 here. It was not a requirement that they are  
16 applicable in full force.

17 The concept, whatever we can use within  
18 the context and applicability of this situation, would  
19 be used. And there is a lot of engineering judgment  
20 both the staff and the licensee has to use in that.  
21 That's where the flexibility is. It's just the  
22 guidance for the staff to -- will do if the material  
23 is there.

24 MR. MACKIN: Pat Mackin from the center.  
25 I'd also add there that we did make a strong effort to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 tailor the use of guidance that was for existing  
2 programs. And there was no intent, I assure you, to  
3 add things that weren't relevant. So if you find  
4 those things, we're really interested in knowing about  
5 them, because they aren't there on purpose.

6 MEMBER LEVENSON: Well, it seems to me the  
7 answer of saying that there is flexibility to not  
8 follow them, kind of raises -- brings into question  
9 why you did this whole exercise. This is supposed to  
10 be the guidance. And if it's -- if there are things  
11 that -- flexibility depending on details of design is  
12 one thing. But flexibility on areas as far afield as  
13 neutron activation and shielding implies that there  
14 couldn't have been a very tight screen if you screened  
15 out irrelevant things.

16 MR. McCARTIN: You raise a good point.  
17 And as Pat indicated, there is nothing in there that  
18 we put in intentionally knowing that it was  
19 irrelevant.

20 MEMBER LEVENSON: Oh, that wasn't my  
21 question.

22 MR. McCARTIN: But we -- part of the  
23 public review and our further review will look for  
24 things that if they shouldn't be in there we want to  
25 get them out, as well as the converse. There might be

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 some things we missed that need to get in there, but  
2 you've identified one. I'd like to think there aren't  
3 a whole lot of those, but we'll find out.

4 MEMBER LEVENSON: Tim, you know that I got  
5 this a couple of days ago. You know, I didn't read  
6 the whole thing.

7 MR. McCARTIN: Right.

8 MEMBER LEVENSON: But scanning it at  
9 random, I can find a few. I have to assume there are  
10 more.

11 MR. McCARTIN: Sure. Sure.

12 MR. JAGANNATH: This is Banad Jagannath  
13 again. In developing the guidance, we have used the  
14 approach of using all of the available reg guides,  
15 guidances, and with a clear understanding it had to be  
16 used as appropriate and as applicable for the case at  
17 hand.

18 Some of them are not exactly made for this  
19 one. This is requiring the staff to go look for where  
20 it is available and use it appropriately.

21 MEMBER GARRICK: I think that's all right,  
22 and you should do that, because we've also been  
23 critical of the agency from time to time for the lack  
24 of consistency in some of the rules and regulations  
25 with respect to the different types of facilities.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           But I think one of the things we're  
2 hopeful that was done was that the experts on this  
3 particular facility sort of sat back and thought about  
4 what makes sense for a license review process. And  
5 then sought out what you have in place that might be  
6 relevant to that. That's what we're saying, rather  
7 than letting what's been done in the back -- in the  
8 background be the driver -- the only driver.

9           CHAIRMAN HORNBERGER: So what I hear is  
10 that you would like to get rid of this kind of thing?

11           MR. McCARTIN: Absolutely.

12           CHAIRMAN HORNBERGER: Okay. Jeff, I have  
13 a question on your planned public meetings. You  
14 mentioned Las Vegas. Do you plan -- is your plan to  
15 do something similar to what you did for Part 63?  
16 That is, a series of meetings? Or is this just one  
17 meeting in Las Vegas. How are you going to use the  
18 experience you gained? And you gained a lot on  
19 Part 63 in doing this.

20           MR. CIOCCO: Yes. I think, well, we're  
21 kind of strategizing right now. But the intention --  
22 and we have a public outreach group who is going to  
23 help me plan this, I sure hope.

24           (Laughter.)

25           But the intention is is to do several

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 meetings around the Las Vegas area, perhaps  
2 sequentially, you know, in one trip out there. But  
3 there's not -- that wouldn't preclude us from doing  
4 other meetings and certainly use whatever lessons  
5 learned from the Part 63 experience.

6 CHAIRMAN HORNBERGER: Do you have any  
7 plans to do a poster for a booth at the Geological  
8 Society of America meeting, or anything of that sort?

9 (Laughter.)

10 MR. CIOCCO: Yes. They don't seem to let  
11 me out of the office much anymore. But, yes.  
12 Certainly, you know, public outreach for the review  
13 plan is there are certainly many avenues that we could  
14 explore in addition to the public closed meetings.  
15 And public outreach is talking about poster boards and  
16 fact sheets and whatever would help somebody  
17 understand how the staff plans to review a license  
18 application if one comes in. And we certainly  
19 entertain those ideas.

20 CHAIRMAN HORNBERGER: Good. I'm glad to  
21 hear that, because the ACNW was very impressed with  
22 what was done for Part 63 in the public meetings and  
23 in the public outreach activities. So I'm glad to  
24 hear that you have some of these same folks helping  
25 you.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. CIOCCO: Yes, we sure do.

2 CHAIRMAN HORNBERGER: Other questions or  
3 comments?

4 Thanks very much, Jeff.

5 MR. CIOCCO: Okay. You're welcome.

6 CHAIRMAN HORNBERGER: Maybe we could take  
7 at least a couple minutes for the committee to do at  
8 least a very initial preliminary assessment of how we  
9 want to proceed with our review of the Yucca Mountain  
10 review plan, while this is all very fresh in our  
11 minds.

12 It seems to me -- well, first of all, let  
13 me just ask a question. Should we make an effort to  
14 focus primarily on postclosure? Any thoughts? Just  
15 a simple yes?

16 MEMBER GARRICK: Well, I think it should  
17 probably be the emphasis, simply because that is the  
18 thrust of the safety case. But I don't think we  
19 should neglect anything. I think the one thing that  
20 we really want to talk about and revisit is try to get  
21 before us -- and it's in the report pretty well --  
22 what was the real underlying and overarching drivers  
23 for the review plan, and have our consideration of the  
24 issues emanate from the -- something that's very  
25 fundamental and basic. At least that strikes me as --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 I'd prefer a top-down approach is what I'm saying.

2 MEMBER LEVENSON: I think I would agree  
3 that we need to look at both parts but use the QA  
4 terminology. Maybe we have a graded approach to --

5 MEMBER GARRICK: Yes.

6 MEMBER LEVENSON: For one thing, the  
7 preclosure incidents that could happen in the facility  
8 and above ground, etcetera, have such an infinitely  
9 small source term compared to the total inventory in  
10 the ground that the potential risk is significant.

11 CHAIRMAN HORNBERGER: So I think we'll  
12 note that. We are certainly not going to ignore  
13 anything, but the main focus would continue to be on  
14 postclosure.

15 The second question I have is, do we want  
16 to in some way -- again, not focused to exclusion --  
17 but concentrate, for example, on the vertical slice  
18 areas that -- or different vertical slices. Because  
19 it strikes me -- Milt had sent me an e-mail, I think,  
20 when we first got the Yucca Mountain review plan that,  
21 to a certain extent, we're faced with some of the  
22 similar problems.

23 Are we going to read it cover to cover and  
24 try to comment in detail on everything? Or would we  
25 gain some benefit by tracing from the -- I think one

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 of the original ideas that Lynn and I had many months  
2 ago was that we would try to trace the evolution from  
3 IRSRs to integrated subissues to the Yucca Mountain  
4 review plan to basically inform our review in terms of  
5 how things -- staff ideas and criteria have evolved.

6 MEMBER GARRICK: Yes, that's part of the  
7 reason for my question about graphics.

8 CHAIRMAN HORNBERGER: Yes, right.

9 MEMBER GARRICK: Is that I think the more  
10 we can put the picture together in some sort of  
11 graphical form and see how all of these components fit  
12 one with the other, I think the better we will be in  
13 terms of being able to assess the effectiveness of the  
14 plan. So we may end up doing some of that ourselves.

15 MEMBER LEVENSON: Yes. I think it just  
16 isn't practical. I don't know about the rest of you  
17 guys, but I don't have enough time to read this kind  
18 of stuff. So we need some kind of sampling and non-  
19 Andersenian audit system.

20 But I'm not sure that the vertical slices  
21 we used before make sense, and it may be that we start  
22 with some of the -- either the points Tim listed or we  
23 select other things that we think make a logical basis  
24 for following through. And, in fact, this has reached  
25 a level of importance that maybe our sources are --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 there are four of us that we don't have to pick our  
2 vertical slices from the same source. Maybe a couple  
3 of points from Tim, and a couple from IRSR, but I  
4 think we need to evolve our audit plan.

5 MEMBER GARRICK: And I think one other  
6 thought process that should guide what we're doing  
7 here is that in the exercises that the staff has been  
8 through through the technical exchange process, they  
9 have already identified some very important issues,  
10 such as, for example, model abstraction.

11 And I think we need to partly be guided by  
12 what has been identified as the issues that were  
13 surfaced during a sufficiency review exercise, and see  
14 if we can be satisfied that this review plan is  
15 thorough enough in regard to those kinds of issues to  
16 get the job done.

17 So there's a number of things I think that  
18 can sharpen our focus. You've mentioned the one --  
19 namely, more emphasis on the postclosure. But I think  
20 the issues that have already been addressed and  
21 surfaced as primary could be another.

22 VICE CHAIRMAN WYMER: Yes, that was the  
23 point I was going to make. I'm glad you made it,  
24 John. I think that we have the burden of guiding  
25 this. We ought to look at the 14 issues that are

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 being integrated and try to consider this review plan  
2 within the context of postclosure and integration.

3 MEMBER GARRICK: That's right. I think  
4 one of the biggest mysteries in this whole process is  
5 the abstraction process. And I think if we could  
6 satisfy ourselves that that was going to be  
7 appropriately considered and dissected, and motivated  
8 by this plan, that would be a very important finding  
9 for us to make.

10 VICE CHAIRMAN WYMER: That's a mechanism  
11 by which we can actually accomplish something.

12 MEMBER GARRICK: Right.

13 CHAIRMAN HORNBERGER: Okay. Now, perhaps  
14 I've -- maybe I'm just confused, but I thought that I  
15 just heard two contradictory things.

16 MEMBER LEVENSON: You did.

17 (Laughter.)

18 CHAIRMAN HORNBERGER: Milt suggested that  
19 we can't do it all, and if we do all 14 subissues  
20 then, in essence, that's what we're going to do.

21 MEMBER GARRICK: Well, I don't think we  
22 should do all 14 subissues.

23 CHAIRMAN HORNBERGER: Okay.

24 MEMBER GARRICK: I'm thinking that --

25 CHAIRMAN HORNBERGER: I think that we're

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 really focusing on the process here.

2 MEMBER GARRICK: Okay.

3 CHAIRMAN HORNBERGER: And whether it's for  
4 issue number 10 or issue number 11, we can be guided  
5 on that by the analyses that have been done to date.

6 MEMBER GARRICK: Right.

7 CHAIRMAN HORNBERGER: And I think that  
8 might be the strategy for assignments more than a  
9 vertical slice.

10 VICE CHAIRMAN WYMER: I think the  
11 important thing is the way the integration is handled  
12 rather than the issues themselves.

13 CHAIRMAN HORNBERGER: Okay. So the  
14 integration is the question, which is a question that  
15 we have had, so I think that's correct. We do have to  
16 make sure that we don't do whatever slice we do and  
17 totally ignore integration.

18 Lynn?

19 MS. DEERING: Along that same line, if  
20 you've followed the theme from yesterday's Commission  
21 briefing, it was the two things you mentioned --  
22 integration as a continuing concern. And it only  
23 takes one example. You don't have to look at 14 ISIs  
24 to worry about integration; you could look at one and  
25 get there.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 But also, risk insights, how those are  
2 actually being applied in this process. If those were  
3 -- just those two themes along could be a thread that  
4 you've been following and --

5 VICE CHAIRMAN WYMER: I think we have to  
6 look at all of them. But I think to pick up on what  
7 Milt said earlier, use the graded approach. Some are  
8 more significant than others.

9 MEMBER LEVENSON: In fact, Lynn, we might  
10 apply what you have said, combined with the concern  
11 about these 14 items. We might review one of these 14  
12 items for how it's all integrated and put together,  
13 etcetera. Pick another one and follow it through to  
14 see how risk insights have been applied or impacted,  
15 etcetera.

16 So that's what I meant by saying the four  
17 of us might have four slightly different types of  
18 slices.

19 CHAIRMAN HORNBERGER: John?

20 MR. LARKINS: I think there was another  
21 issue that came out of yesterday's Commission meeting,  
22 where Commissioner McGaffigan raised the question of  
23 not only assuring this is risk-informed but also not  
24 requesting too much information and having a  
25 reasonable expectation standard now. What does that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 mean in terms of acceptance criteria as opposed to  
2 reasonable assurance? So that may be something that  
3 you want to consider in doing this also.

4 MEMBER GARRICK: Good suggestion. I think  
5 that is important.

6 MR. LARKINS: It wasn't clear to me, from  
7 just scanning through the document, how things have  
8 changed in terms of acceptance criteria in going from  
9 one standard to the other. But I think it's something  
10 we could talk to the staff offline about.

11 CHAIRMAN HORNBERGER: I think that's good.

12 Let's see, before we break, I just wanted  
13 to ask Jeff if he had any particular -- Jeff or Pat,  
14 would you like to point us in any particular  
15 direction? Is there anything we've articulated you  
16 would like to --

17 MEMBER LEVENSON: Or a direction you'd  
18 like to point us away from.

19 CHAIRMAN HORNBERGER: Oh, yes.

20 (Laughter.)

21 Go ahead and tell us that. We won't  
22 listen, but --

23 (Laughter.)

24 MR. MACKIN: I thought two things that  
25 might be useful are at the beginning of each major

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 section there is a description of the approach we've  
2 taken to try to make it risk-informed and performance-  
3 based.

4 And as Tim mentioned in his briefing,  
5 since the 14 model abstraction sections all use the  
6 same five basic acceptance criteria, it kind of fit in  
7 with what all of you were saying, is that you don't  
8 have to look at all of them to see how, in general,  
9 they've been constructed.

10 MR. CIOCCO: Yes. I think he's right.  
11 That's certainly -- you certainly need to look at the  
12 upfront information and how the whole -- for instance,  
13 if you -- I mean, if you're interested in postclosure,  
14 there was an attempt at front end -- some of that  
15 resulted from our prior discussions with some of the  
16 members on how the whole process is going to work,  
17 just to keep that in mind. But no other further  
18 direction.

19 CHAIRMAN HORNBERGER: What I suggest,  
20 then, is that perhaps Richard and I could put our  
21 heads together or through e-mail come up with some  
22 kind of draft plan as to how we're going to proceed  
23 and circulate that and get comments and try to iterate  
24 on this. I think we have some good ideas now.

25 MEMBER LEVENSON: You might, again,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 combine -- take the idea of checking the criteria and  
2 pick one of the things in the 14 listed, and follow  
3 that through. So a different one than the other.

4 VICE CHAIRMAN WYMER: That's one other  
5 thought here. It's not as overarching as all of the  
6 things we've been discussing, but let's pay some  
7 attention to the definition of safety standards and  
8 what would get to this question.

9 MEMBER LEVENSON: I have a question, which  
10 I forgot to ask. In the review plan where you have  
11 lists of all of the codes and standards and everything  
12 that you expect to see followed, in the world of DOE,  
13 what is conspicuous by its absence is all of the DOE  
14 orders and standards, etcetera, which in some cases  
15 conflict with the commercial codes and standards that  
16 you have applied. Is there any significance to this?

17 MR. MACKIN: In think in general, in the  
18 review plan where we listed codes and standards, they  
19 were listed as examples and not as requirements, and  
20 to show the types of documents that we thought  
21 appropriate. There was no -- Banad, there was no  
22 attempt to screen out DOE orders or anything there.

23 MEMBER LEVENSON: Well, not, but I -- but  
24 the question is, since you did list them, is the  
25 implication that the commercial standards would be

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 considered adequate by NRC?

2 MR. MACKIN: Yes. I think the general  
3 philosophy is that DOE selects the codes and standards  
4 they are going to use, justifies that they're  
5 appropriate, and Part 63 presents no ruling in or  
6 ruling out of any of those. And then demonstrates  
7 that they use them properly.

8 MR. CIOCCO: That's correct. And I think  
9 if you look in the preclosure section the codes and  
10 standards really come under the review methods where  
11 staff is going to review what the DOE has submitted.  
12 I don't think under the acceptance criteria you'll  
13 find the codes and standards. It's certainly up to  
14 DOE to use whatever they feel is applicable, whether  
15 it's a DOE order, an NRC NUREG guidance document. DOE  
16 certainly has that flexibility.

17 CHAIRMAN HORNBERGER: Any other comments?  
18 Questions? Clarifications? Apologies?

19 (Laughter.)

20 Okay. We are now going to -- we are then  
21 going to break. We'll break until 1:00. We'll  
22 reconvene at 1:00.

23 (Whereupon, at 11:55 a.m., the  
24 proceedings in the foregoing matter went  
25 off the record for a lunch break.)

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

CERTIFICATE

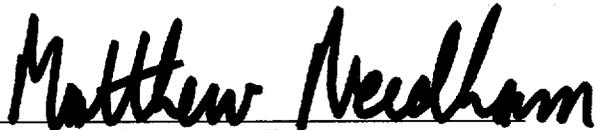
This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: ACNW 133<sup>rd</sup> Meeting

Docket Number: N/A

Location: Rockville, MD

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.



Matthew Needham  
Official Reporter  
Neal R. Gross & Co., Inc.

# **YUCCA MOUNTAIN REVIEW PLAN (YMRP) INTRODUCTION**



Presented by

Jeff Ciocco (Nuclear Regulatory Commission)  
Pat Mackin (Center for Nuclear Waste Regulatory Analyses)

133<sup>rd</sup> Advisory Committee on Nuclear Waste Meeting  
March 21, 2002  
Rockville, Maryland

ACNW-3/2002-Introduction-Page 1



## **Briefing Agenda**

---

- Status and Structure of YMRP
- Regulatory Philosophy
- YMRP a Living Document
- Acceptance Review
- Review for General Information and Administrative and Programmatic Requirements
- Step-Wise Licensing Approach

ACNW-3/2002-Introduction-Page 2



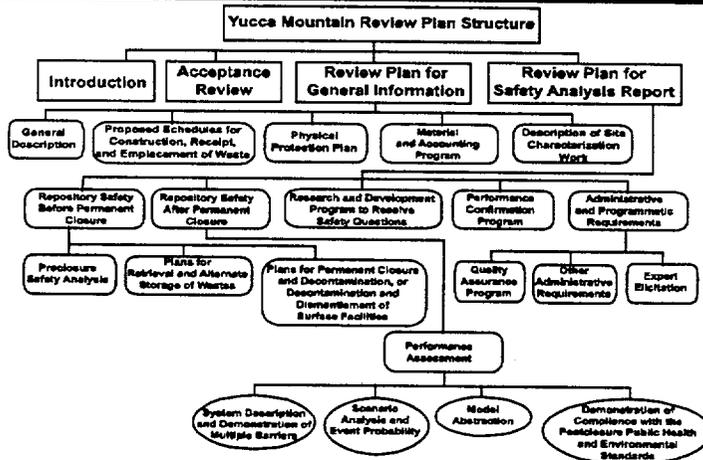
## YMRP Status

- Last Briefed ACNW on March 28, 2000
  - All YMRP sections were under development
- YMRP Draft Revision 1 Made Public for Information Only on 11/30/2001: Not Consistent With Final Yucca Mountain Regulations
- Available on NRC Public Website, Revision 2, Draft Report for Comment
  - Copies provided to support this meeting
- NUREG Expected to be Released at End of March Followed by Federal Register Notice and Request for Public Comments

ACNW-3/2002-Introduction-Page 3



## Structure of YMRP



ACNW-3/2002-Introduction-Page 4



## Structure of YMRP Sections

---

- Consistent With Other NRC Review Plans
- Areas of Review
  - Topical areas
  - Scope
- Review Methods
  - Step-by-step procedures
  - Level of detail and complexity determined by regulatory requirements and nature of technical issues
- Acceptance Criteria
  - Define acceptable compliance demonstration
    - Regulatory requirements and regulatory guides
    - Codes and standards
    - Results of staff investigations
- Evaluation Findings
  - Examples of general findings suitable for a safety evaluation report
- References

ACNW-3/2002-Introduction-Page 5



## Regulatory Philosophy

---

- Licensing Review Philosophy
  - NRC does not select sites or designs
  - NRC reviews are comprehensive but focus on areas most important to safety or waste isolation
  - NRC Defends Its Licensing Decision, DOE Defends Its Safety Case
  - Look for reasonable assurance (preclosure) and reasonable expectation (postclosure) of compliance
- YMRP Implements 10 CFR Part 63; A Risk-Informed, Performance-Based (RIPB), Site-Specific Rule
- YMRP Incorporates More Than 15 Years of Staff Knowledge and Avoids Prescriptive Acceptance Criteria
- Subsequent Presenters Will Discuss RIPB Aspects of Their Sections

ACNW-3/2002-Introduction-Page 6



## Regulatory Philosophy (continued)

---

- General License Application Review Process
  - Conduct acceptance review for docketing
  - Conduct detailed technical review
  - Begin preparing a draft safety evaluation report
  - If necessary, develop requests for additional information

ACNW-3/2002-Introduction-Page 7



## Regulatory Philosophy (continued)

---

- Use RIPB Features in YMRP such as:
  - Review Methods/Acceptance Criteria Are Focused on Assessing Compliance With Performance Objectives in 10 CFR Part 63
  - Postclosure Safety Review Has Separate Sections for Areas the Staff Has Determined to be Most Important to Waste Isolation
  - Acceptance Criteria Are Flexible Rather Than Prescriptive
    - DOE must select compliance demonstration methods, show they are appropriate, and use them properly (the safety case)
  - Substantial Cross-Referencing Exists Between Review Plan Sections
  - YMRP Written to Address Any Step of Licensing
    - Future revisions are likely as experience is gained

ACNW-3/2002-Introduction-Page 8



## YMRP A Living Document

---

- Revision 2, Draft Report for Comment, Seeks Public Comment and ACNW Review
- NRC Staff Will Incorporate Comments, as Appropriate, and Provide a Revised Document to the Commission
- In Light of Terrorist Attacks of September 11, 2001, the Commission Has Directed Staff to Conduct a Comprehensive Evaluation of NRC Physical Protection Requirements
  - If these efforts indicate NRC regulations and requirements need revision, they would occur through appropriate methods, and, if necessary, the YMRP would be revised accordingly
- Multi-Step Licensing Process in 10 CFR Part 63 Provides Opportunities to Revise YMRP, if Necessary

ACNW-3/2002-Introduction-Page 9



## Acceptance Review

---

- First Screening of DOE License Application Using Acceptance Checklist Based on Regulatory Requirements for the Content of a License Application (10 CFR 63.21)
- Determines Completeness of Information
  - Information must be sufficient to permit safety review to commence
  - Ninety days will be allowed
- Results
  - Accept for review
  - Accept, but request additional information
  - Reject, inadequate to support detailed review

ACNW-3/2002-Introduction-Page 10



## Review for General Information

---

- Examines Overview Information for Site and Design
  - General description (no detailed technical review)
  - Proposed schedules for construction, receipt, and emplacement of waste (no detailed technical review)
  - Physical protection plan (requires compliance with 10 CFR 73.51)
  - Material control and accounting (consistent with existing programs)
  - Description of site characterization work (no detailed technical review)

ACNW-3/2002-Introduction-Page 11



## Review for Administrative and Programmatic Requirements

---

- Includes Various Operational Requirements
  - Quality assurance
  - Records, reports, tests, and inspections
  - Training and certification of personnel
  - Expert elicitation
  - Plans for startup activities and testing
  - Plans for conduct of normal activities, including maintenance, surveillance, and periodic testing
  - Emergency planning
  - Controls to restrict access and regulate land uses
  - Uses of the geologic repository operations area for purposes other than disposal of radioactive wastes
  - License specifications
- No Performance Objectives Are Provided in 10 CFR Part 63
- Used Existing NRC Programs and Looked for Opportunities to Modify Prescriptive Acceptance Criteria

ACNW-3/2002-Introduction-Page 12



## Multi-Step Licensing Approach

- 10 CFR Part 63 Allows for Well-Defined Steps in Licensing With Incremental Decision Points That Allow for Continual Learning and Progressive Confidence
- Three Steps of Licensing
  - Construction Authorization (63.31): based on site characterization results
    - Reasonable expectation that disposal poses no unreasonable risk to health and safety of the public
    - Will comply with performance objectives subject to conditions for safety
  - License to Receive and Possess (63.41): informed by construction activity and performance confirmation program
    - Updated application (63.24): data obtained during construction, performance confirmation, as-builts; underground systems for initial operation substantially complete; and adequate measures for radiological emergencies, retrievability, and permanent closure
  - Amendment for Permanent Closure (63.51): updated by performance program
    - Updated application (63.24): performance confirmation program, data obtained from operational experience, post-permanent closure monitoring program, and continued oversight

ACNW-3/2002-Introduction-Page 13



## Multi-Step Licensing Approach (continued)

- Staff Intends to Use the YMRP to Conduct Reviews of a Potential License Application With Respect to Both Construction Authorization and Licensing to Receive and Possess Waste
- Although There Are Some Differences in the Requirements of 10 CFR 63.31 (Construction Authorization) and 10 CFR 63.41 (Standards for Issuance of a License), the Requirements are Generally Similar
- Accordingly, the Evaluation Findings Contained in the YMRP Were Prepared to be Suitable for Both Reviews
- At the Time of Review for Construction Authorization, Several Aspects of Regulatory Compliance Demonstration Will be Based on a Commitment by DOE Rather Than Hard Evidence (e.g., Training Program, Personnel Qualification Records, Emergency and Operating Procedures, and Maintenance Plans)

ACNW-3/2002-Introduction-Page 14

# PRECLOSURE SAFETY ASSESSMENT



Presented by  
Banad Jagannath (Nuclear Regulatory Commission)

133<sup>rd</sup> Advisory Committee on Nuclear Waste Meeting  
March 21, 2002  
Rockville, Maryland

ACNW-3/2002-Preclosure-Page 1



## Outline of Presentation

---

- Organization of Preclosure Safety Assessment Review
- Development of an RIPB Preclosure Safety Assessment Review

ACNW-3/2002-Preclosure-Page 2



## Organization of Preclosure Safety Assessment

---

- A Sequence of Evaluations Leading From Site Characterization to Compliance With 10 CFR Part 63 Preclosure Performance Objectives
  - Site description as it pertains to preclosure safety analysis
  - Description of structures, systems, components, equipment, and operational process activities
  - Identification of hazards and initiating events
  - Identification of event sequences
  - Consequence analysis methodology and demonstration that the design meets 10 CFR Parts 20 and 63 numerical radiation protection requirements for normal operations and Category 1 event sequences, and Category 2 event sequences
  - Identification of structures, systems, and components important to safety; safety controls; and measures to ensure availability of the safety systems

ACNW-3/2002-Preclosure-Page 3



## Organization of Preclosure Safety Assessment (continued)

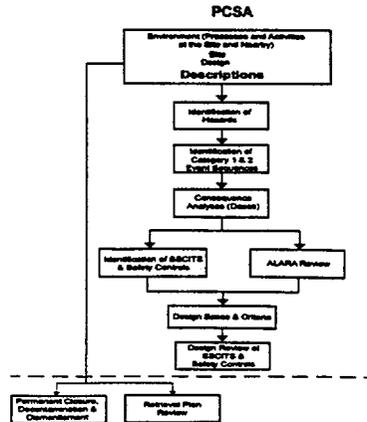
---

- A Sequence of Evaluations Leading From Site Characterization to Compliance With 10 CFR Part 63 Preclosure Performance Objectives (continued)
  - Design of structures, systems, and components important to safety and safety controls
  - Meeting the 10 CFR Part 20 as low as is reasonably achievable requirements for normal operations and Category 1 event sequences
- Other Sections of the Preclosure Safety assessment
  - Plans for retrieval and alternate storage of radioactive wastes
  - Plans for permanent closure and decontamination, or decontamination and dismantlement of surface facilities

ACNW-3/2002-Preclosure-Page 4



## Organization of Preclosure Safety Assessment (continued)



ACNW-3/2002-Preclosure-Page 5



## Development of an RIPB Preclosure Safety Assessment

- Purpose of Review Is to Evaluate Compliance With 10 CFR Part 63 Preclosure Performance Objectives
  - Permissible doses to workers and public
  - ALARA considerations
  - Based on risk from radiation exposures
- 10 CFR Part 63 Specifies a Preclosure Safety Assessment
  - Systematic examination of the site, design, hazards, initiating events, event sequences, and consequences (doses)
  - Considers uncertainty in data
- Event Sequences are Defined Based on Well-Established Methodologies
- Dose Consequences Used for Compliance Determination and to Identify Structures, Systems, Components, and Controls Important to Safety
- Design of Structures, Systems, Components, and Controls Important to Safety
- Structures, Systems, and Components May be Further Categorized Based on Relative Safety Significance Using Risk Information
  - May be linked to a graded quality assurance program
- Staff Review Focuses on DOE Preclosure Safety Assessment Execution and Systems, Subsystems, and Components Important to Safety
  - Rigor of review to depend on relative safety significance

ACNW-3/2002-Preclosure-Page 6



## Development of an RIPB Preclosure Safety Assessment (continued)

---

- NRC Acceptance Criteria Are Not Prescriptive
  - DOE has flexibility and responsibility to develop design criteria and bases, demonstrate their appropriateness, and use them properly
- Staff Will Review DOE Preclosure Safety Case
  - NRC PCSA tool will assist but not be the basis for the review
  - A confirmatory technique
- Plans for Retrieval and Alternate Storage of Waste
  - No prescriptive acceptance criteria
  - DOE has flexibility to design these plans
- Plans for Permanent Closure, Decontamination, Dismantlement
  - No prescriptive acceptance criteria
  - Evaluate design considerations to facilitate closure and decontamination
  - Evaluate plans for closure and decontamination
  - YMRP acknowledges that this section will be preliminary

ACNW-3/2002-Preclosure-Page 7

# POSTCLOSURE SAFETY ASSESSMENT



Presented by  
Tim McCartin (Nuclear Regulatory Commission)

133<sup>rd</sup> Advisory Committee on Nuclear Waste Meeting  
March 21, 2002  
Rockville, Maryland

ACNW-3/2002-Postclosure-Page 1



## Outline of Presentation

---

- Organization of Postclosure Safety Assessment Review
- Development of an RIPB Postclosure Safety Assessment Review

ACNW-3/2002-Postclosure-Page 2



## Organization of Postclosure Safety Assessment Review

---

- Based on Compliance With 10 CFR Part 63 Postclosure Performance Objectives
- System Description and Demonstration of Multiple Barriers
- Scenario Analysis
- Identification of Events With Probabilities Greater Than  $10^{-8}$  Per Year
- Model Abstraction Sections Evolved From Key Technical Issues and Associated Integrated Subissues
  - Provides for comprehensive review of system behavior
  - Areas most important to performance focus reviews

ACNW-3/2002-Postclosure-Page 3



## Organization of Postclosure Safety Assessment Review (continued)

---

- Model Abstraction
  - Evolved from key technical issues
  - Multidisciplinary subjects shown important to describing and understanding system behavior
  - Staff has cross walked these to key technical issues to ensure coverage
  - Fourteen abstractions
    - Degradation of engineered barriers
    - Mechanical disruption of engineered barriers
    - Quantity and chemistry of water contacting waste packages and waste forms
    - Radionuclide release rates and solubility limits
    - Climate and infiltration
    - Flow paths in the unsaturated zone
    - Radionuclide transport in the unsaturated zone

ACNW-3/2002-Postclosure-Page 4



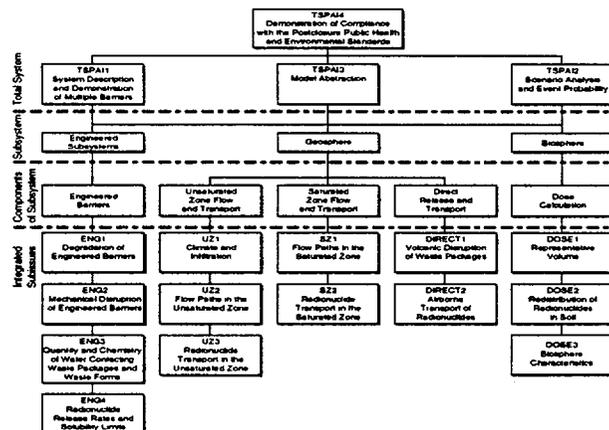
## Organization of Postclosure Safety Assessment Review (continued)

- Model Abstraction—Fourteen Abstractions (continued)
  - Flow paths in the saturated zone
  - Radionuclide transport in the saturated zone
  - Volcanic disruption of waste packages
  - Airborne transport of radionuclides
  - Representative volume
  - Redistribution of radionuclides in soil
  - Biosphere characteristics
- Demonstration of Compliance With the Postclosure Public Health and Environmental Standards (Three Parts)
  - Demonstration of compliance with the postclosure individual protection standard
  - Demonstration of compliance with the human intrusion standard
  - Analysis of repository performance that demonstrates compliance with separate groundwater protection standards

ACNW-3/2002-Postclosure-Page 5



## Development of an RIPB Postclosure Safety Assessment



ACNW-3/2002-Postclosure-Page 6



## Development of an RIPB Postclosure Safety Assessment Review

- Staff Review Is focused on Compliance With 10 CFR Part 63 Performance Objectives
  - Understanding of system behavior (technical support for assumptions, models, and parameters)
  - Multiple lines of evidence (information from detailed process level models, laboratory and field experiments, and natural analogs)
- Risk Information Is Used to Focus the Review
  - Emphasize items most important to performance
- Multiple Barrier Analysis
  - Identification of barriers
  - Barrier capability (provides understanding of system behavior)
  - Focuses reviews of scenario analysis, event probability, and model abstraction
- Scenario Analysis
  - Examines nominal and disruptive events
  - Reviews identification and screening of features, events, and processes and construction of scenarios (unlikely and very unlikely)

ACNW-3/2002-Postclosure-Page 7



## Development of an RIPB Postclosure Safety Assessment (continued)

- Model Abstraction
  - Based on prior performance assessments, knowledge of site characteristics, and repository design
  - Model abstractions will have varying risk significance
  - Review effort will depend on final DOE safety case
  - Each model abstraction uses same five generic acceptance criteria
    - Adequate system description and model integration
    - Sufficient data for model justification
    - Adequate characterization and propagation of data uncertainty
    - Adequate characterization and propagation of model uncertainty
    - Adequate support for model abstraction output through objective comparisons

ACNW-3/2002-Postclosure-Page 8



## Development of an RIPB Postclosure Safety Assessment (continued)

---

- Demonstration of Compliance With Postclosure Public Health and Environmental Standards
  - Criterion for compliance is reasonable expectation
  - Combine probability estimates from scenario analysis with consequence estimates from model abstraction for repository risk estimate
  - Consider parameter uncertainty and alternate conceptual models
  - Use similar techniques for all three performance objectives

ACNW-3/2002-Postclosure-Page 9



## Staff Analyses in Support of Safety Assessment Review

---

- Quantitative Understanding of Each Barrier's Capability
  - Delay of release due waste package lifetime
  - Limited amount of water for contacting waste
  - Slow release rates from waste form
  - Delay of specific radionuclides due to retardation and low ground-water flow (unsaturated and saturated zones)
- Sensitivity Analyses
  - Risk insights on overall performance
  - Considerations of differences between NRC and DOE approaches
- Focused Analyses (PA and process level models)
  - Support requests for information from DOE

ACNW-3/2002-Postclosure-Page 10



## **Staff Analyses in Support of Safety Assessment Review (continued)**

---

- Ground-Water Protection Standards
  - Estimates of concentrations and doses performed as part of individual protection calculation (i.e., intermediate result)
  - Unlikely events not considered
- Stylized Human Intrusion Analyses
  - Review of DOE estimate for time of occurrence of intrusion
  - Review implementation of characteristics of intrusion

ACNW-3/2002-Postclosure-Page 11



## **Summary**

---

- Understanding of System Behavior
- Technical Basis Commensurate with Risk Importance
- Focused Analyses Assist Review

ACNW-3/2002-Postclosure-Page 12

# REVIEW OF RESEARCH AND DEVELOPMENT PROGRAM TO ADDRESS SAFETY QUESTIONS AND PERFORMANCE CONFIRMATION



Presented by  
Pat Mackin (Center for Nuclear Waste Regulatory Analyses)  
Jeff Pohle (Nuclear Regulatory Commission)

133<sup>rd</sup> Advisory Committee on Nuclear Waste Meeting

March 21, 2002  
Rockville, Maryland

ACNW-3/2002-R&D/PC-Page 1



## Outline of Presentation

---

- Development of an RIPB Review Plan to Address Safety Questions
- Development of an RIPB Review Plan for Performance Confirmation

ACNW-3/2002-R&D/PC-Page 2



## Development of an RIPB Review Plan to Address Safety Questions

---

- Safety Questions Are Adequately Identified and Described
- Research and Development Programs Are Reasonable
  - Address issues related to structures, systems, and components important to safety or engineered and natural barriers important to waste isolation
- Schedules for Addressing Questions Are Reasonable
  - Consistent with repository startup schedule
- Design Alternatives or Operational Restrictions Are Acceptable
- Staff Must Determine Whether Construction Is Appropriate Considering the Integrated Effects of Safety Questions
- Review Is Focused on Items Most Important to Safety and Waste Isolation
- Acceptance Criteria Are Nonprescriptive
- Safety Questions Are Outside the Scope of Items Identified for Performance Confirmation

ACNW-3/2002-R&D/PC-Page 3



## Development of an RIPB Review Plan for Performance Confirmation

---

- Tests, Experiments and Analyses to Evaluate Adequacy of Information Used to Demonstrate Compliance With Performance Objectives
- Regulatory Requirements Unique to High-Level Waste Program
  - Address uncertainties in estimating geologic performance over thousands of years
- Performance Confirmation Focuses on Natural and Engineered Systems and Components Important to Performance

ACNW-3/2002-R&D/PC-Page 4



## Development of an RIPB Review Plan for Performance Confirmation (continued)

---

- Acceptance Criteria Are Taken From Performance-Based Regulatory Requirements in 10 CFR Part 63
  - Performance confirmation program meets general requirements
    - Actual conditions are within limits assumed in license application
    - Natural and engineered barriers are functioning as intended and expected
    - Includes *in situ* monitoring, *in situ* experiments, and laboratory and field testing
    - Program will continue until closure
    - Procedures are provided to manage program
  - Performance confirmation program for geotechnical and design parameters is adequate
    - DOE has the flexibility and responsibility to determine which natural systems and components to test/monitor
    - Measuring, testing, geologic mapping
    - Monitoring and surveillance program
  - Performance confirmation program for design testing is adequate
    - DOE has the flexibility and responsibility to determine which engineered systems and components to test/monitor
    - Thermal interaction of waste packages, rock, water, and engineered systems and components
    - Schedule allows results to be considered in design
    - Backfill placement and compaction
    - Borehole, shaft, and ramp seals

ACNW-3/2002-R&D/PC-Page 5



## Development of an RIPB Review Plan for Performance Confirmation (continued)

---

- Acceptance Criteria Are Taken From Performance-Based Regulatory Requirements in 10 CFR Part 63 (continued)
  - Performance confirmation program for monitoring and testing waste packages is adequate
    - Waste packages and emplacement environment are representative
    - Laboratory experiments focus on waste package internal conditions
    - Monitoring and testing will continue up to the time of permanent closure

ACNW-3/2002-R&D/PC-Page 6

# QUALITY ASSURANCE PROGRAM REVIEW



Presented by

Larry Campbell (Nuclear Regulatory Commission)

133<sup>rd</sup> Advisory Committee on Nuclear Waste Meeting

March 21, 2002

Rockville, Maryland

ACNW-3/2002-QA-Page 1



## Graded Quality Assurance

- The YMRP Has Flexibility to Support Evaluation of a Graded or Non-Graded QA Program
- Non-Graded QA Program—All Structures, Systems, and Components Important to Safety or Barriers Important to Waste Isolation Must Meet Full Scope of QA Requirements
- Graded QA Program—Low Safety- or Risk-Significant Items May Meet Reduced Scope of QA Requirements
- QA and Technical Reviewers Will Interface to Ensure Acceptability

ACNW-3/2002-QA-Page 2



## Risk-Informed Aspects of Quality Assurance Review

---

- Risk Information Will Be Used to Identify Structures, Systems, and Components Important to Safety and Barriers Important to Waste Isolation
  - Those items to which a QA program will apply
- If DOE Applies a Graded QA System, Risk Information Will Be Used to Scope Application of QA Requirements

ACNW-3/2002-QA-Page 3



## Acceptance Criteria: Quality Assurance Program

---

- The YMRP Has Established Criteria for Evaluating the DOE QA Program in the Following Areas—These Criteria Are Consistent With Established NRC Practice in Evaluating Quality Assurance Programs
  - Quality assurance organization
  - Quality assurance program
  - Design control
  - Procurement document control
  - Instructions, procedures, and drawings
  - Document control
  - Control of purchased material, equipment, and services
  - Identification and control of materials, parts, and components
  - Control of special processes
  - Inspection

ACNW-3/2002-QA-Page 4



## **Acceptance Criteria: Quality Assurance Program (continued)**

---

- Test control
- Control of measuring and test equipment
- Handling, storage, and shipping
- Inspection, test, and operating status
- Nonconforming materials, parts, or components
- Corrective action
- Quality assurance records
- Audits
- Software
- Sample control
- Scientific investigation
- Field surveys



[Site Help](#) | [Site Index](#) | [Contact Us](#)

[Advanced Search](#)

## U.S. Nuclear Regulatory Commission



[Home](#)

[Who We Are](#)

[What We Do](#)

[Nuclear Reactors](#)

[Nuclear Materials](#)

[Radioactive  
Waste](#)

[Public  
Involvement](#)

[Electronic  
Reading Room](#)

[Home](#) > [Electronic Reading Room](#) > [Document Collections](#) > [News Releases](#) > 02-026



### NRC NEWS U.S. NUCLEAR REGULATORY COMMISSION

Office of Public Affairs Telephone:

301/415-8200

Washington, DC  
20555-001

E-mail: [opa@nrc.gov](mailto:opa@nrc.gov)

[www.nrc.gov](http://www.nrc.gov)

No. 02-026

March 4, 2002

#### **NRC MAKES AVAILABLE REVISION 2 OF DRAFT REVIEW PLAN FOR YUCCA MOUNTAIN**

The Nuclear Regulatory Commission is making publicly available Draft Revision 2 of a plan that it would use to review an application to build a potential high-level nuclear waste repository at Yucca Mountain, Nevada, if the Department of Energy (DOE) submits such an application. The principal purpose of the Yucca Mountain Review Plan would be to ensure the quality and uniformity of the NRC staff's licensing reviews.

An earlier, out-of-date version of the draft plan which was not consistent with NRC's final regulations was made public last year. The revision being made available today was revised to be consistent with NRC final regulations on Yucca Mountain, issued in November 2001.

The plan has separate sections for potential reviews of repository safety before permanent closure, safety after permanent closure, the performance confirmation program and administrative and programmatic requirements. Each of these sections would define NRC's review of DOE's compliance with NRC regulations.

The "Yucca Mountain Review Plan, Draft Revision 2" is available electronically through the NRC's website at <http://www.nrc.gov/waste/hlw-disposal/draft-yucca-plan.pdf>.

The NRC plans to issue in several weeks a Federal Register notice requesting public comments on the draft. The agency also plans to hold public meetings, with dates, times and locations to be announced later.

# POSTCLOSURE SAFETY ASSESSMENT



Presented by  
Tim McCartin (Nuclear Regulatory Commission)

133<sup>rd</sup> Advisory Committee on Nuclear Waste Meeting  
March 21, 2002  
Rockville, Maryland

ACNW-3/2002-Postclosure-Page 1



## Outline of Presentation

---

- Organization of Postclosure Safety Assessment Review
- Development of an RIPB Postclosure Safety Assessment Review

ACNW-3/2002-Postclosure-Page 2



## Organization of Postclosure Safety Assessment Review

---

- Based on Compliance With 10 CFR Part 63 Postclosure Performance Objectives
- System Description and Demonstration of Multiple Barriers
- Scenario Analysis and Event Probabilities
- Identification of Events With Probabilities Greater Than  $10^{-8}$  Per Year
- Model Abstraction Sections Evolved From Key Technical Issues and Associated Integrated Subissues
  - Provides for comprehensive review of system behavior
  - Evolved from key technical issues
  - Multidisciplinary subjects shown important to describing and understanding system behavior
  - Areas most important to performance focus reviews
  - Staff has cross walked these to key technical issues to ensure coverage

ACNW-3/2002-Postclosure-Page 3



## Organization of Postclosure Safety Assessment Review (continued)

---

- Fourteen Model Abstraction
  - Degradation of engineered barriers
  - Mechanical disruption of engineered barriers
  - Quantity and chemistry of water contacting waste packages and waste forms
  - Radionuclide release rates and solubility limits
  - Climate and infiltration
  - Flow paths in the unsaturated zone
  - Radionuclide transport in the unsaturated zone
  - Flow paths in the saturated zone
  - Radionuclide transport in the saturated zone
  - Volcanic disruption of waste packages
  - Airborne transport of radionuclides
  - Representative volume
  - Redistribution of radionuclides in soil
  - Biosphere characteristics

ACNW-3/2002-Postclosure-Page 4



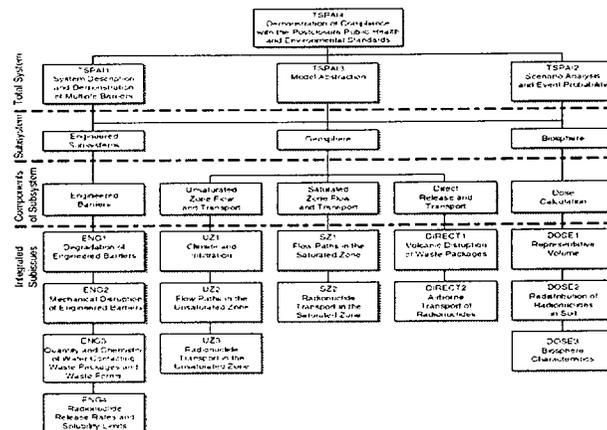
## Organization of Postclosure Safety Assessment Review (continued)

- Demonstration of Compliance With the Postclosure Public Health and Environmental Standards (Three Parts)
  - Demonstration of compliance with the postclosure individual protection standard
  - Demonstration of compliance with the human intrusion standard
  - Analysis of repository performance that demonstrates compliance with separate groundwater protection standards

ACNW-3/2002-Postclosure-Page 5



## Development of an RIPB Postclosure Safety Assessment Review



ACNW-3/2002-Postclosure-Page 6



## Development of an RIPB Postclosure Safety Assessment Review

- Staff Review Is focused on Compliance With 10 CFR Part 63 Performance Objectives
  - Understanding of system behavior (technical support for assumptions, models, and parameters)
  - Multiple lines of evidence (information from detailed process level models, laboratory and field experiments, and natural analogs)
- Risk Information Is Used to Focus the Review
  - Emphasize items most important to performance
- Multiple Barrier Analysis
  - Identification of barriers
  - Barrier capability (provides understanding of system behavior)
  - Focuses reviews of scenario analysis, event probability, and model abstraction
- Scenario Analysis
  - Examines nominal and disruptive events
  - Reviews identification and screening of features, events, and processes and construction of scenarios (unlikely and very unlikely)

ACNW-3/2002-Postclosure-Page 7



## Development of an RIPB Postclosure Safety Assessment Review (continued)

- Model Abstraction
  - Based on prior performance assessments, knowledge of site characteristics, and repository design
  - Model abstractions will have varying risk significance
  - Review effort will depend on final DOE safety case
  - Each model abstraction uses same five generic acceptance criteria
    - Adequate system description and model integration
    - Sufficient data for model justification
    - Adequate characterization and propagation of data uncertainty
    - Adequate characterization and propagation of model uncertainty
    - Adequate support for model abstraction output through objective comparisons

ACNW-3/2002-Postclosure-Page 8



## Development of an RIPB Postclosure Safety Assessment Review (continued)

---

- Demonstration of Compliance With Postclosure Public Health and Environmental Standards
  - Criterion for compliance is reasonably expectation
  - Combine probability estimates from scenario analysis with consequence estimates from model abstraction for repository risk estimate
  - Considers parameter uncertainty and alternate conceptual models
  - Use similar techniques for all three performance objectives

ACNW-3/2002-Postclosure-Page 9



## Staff Analyses in Support of Postclosure Safety Assessment Review

---

- Quantitative Understanding of Each Barrier's Capability
  - Delay of release due waste package lifetime
  - Limited amount of water for contacting waste
  - Slow release rates from waste form
  - Delay of specific radionuclide due to retardation and low ground-water flow (unsaturated and saturated zones)
- Sensitivity Analyses
  - Risk insights on overall performance
  - Considerations of differences between NRC and DOE approaches
- Focused Analyses (PA and process level models)
  - Support requests for information from DOE

ACNW-3/2002-Postclosure-Page 10



## Staff Analyses in Support of Postclosure Safety Assessment Review (continued)

---

- Ground-Water Protections Standards
  - Estimates of concentrations and doses performed as part of individual protection calculation (i.e., intermediate result)
  - Unlikely events not considered
- Stylized Human Intrusion Analyses
  - Review of DOE estimate for time of occurrence of intrusion
  - Review implementation of characteristics of intrusion
  - Unlikely events not considered

ACNW-3/2002-Postclosure-Page 11



## Summary

---

- Understanding of System Behavior
- Technical Basis Commensurate with Risk Importance
- Focused Analyses Assist Review

ACNW-3/2002-Postclosure-Page 12