

1 UNITED STATES OF AMERICA  
2 NUCLEAR REGULATORY COMMISSION  
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4 MEETING WITH THE ADVISORY COMMITTEE  
5 ON NUCLEAR WASTE

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7 NUCLEAR REGULATORY COMMISSION

8 1 White Flint North  
9 Rockville, Maryland

10 + + + +  
11 Wednesday, March 20, 2002

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13 The Commission met in open session, pursuant  
14 to notice, at 9:30 a.m., the Honorable RICHARD A.  
15 MESERVE, Chairman of the Commission, presiding.

16 COMMISSIONERS PRESENT:

17 RICHARD A. MESERVE, Chairman  
18 GRETA J. DICUS, Member  
19 NILS J. DIAZ, Member  
20 EDWARD McGAFFIGAN, JR., Member  
21 JEFFREY S. MERRIFIELD, Member

22 (This transcript produced from electronic  
23 caption media and audio and video media provided by  
24 the Nuclear Regulatory Commission.)

25

1 STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

2 GEORGE M. HORNBERGER, CHAIR, ACNW

3 B. JOHN GARRICK, ACNW

4 RAYMOND G. WYMER, VICE CHAIR, ACNW

5 MILTON N. LEVENSON, ACNW MEMBER

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

2 CHAIRMAN MESERVE: The Commission is  
3 meeting this morning to hear from the Advisory  
4 Committee on Nuclear Waste on the status of the  
5 Committee's activities conducted over the past year.

6 As I'm sure everyone in the audience knows,  
7 the Committee advises the Commission on a wide variety of issues related  
8 to radioactive waste disposal and site decommissioning.

9 The Commission was last briefed by the  
10 Committee in March of last year.

11 Since that meeting, there are a number of  
12 events that have occurred in the national scene that  
13 impacted the Committee's activities.

14 Perhaps, the one that has attracted the  
15 greatest attention is the fact that DOE has made its  
16 site recommendation to President Bush, and the  
17 President has forwarded the recommendation on to  
18 Congress.

19 Congress could conceivably act in this  
20 session to resolve the issue and that's the matter  
21 that will be before us, possibly for licensing.

22 The Committee's briefing today focuses on  
23 Yucca Mountain matters and it's particularly timely  
24 in light of the events that are underway.

25 We are very interested in hearing the

1 Committee's views.

5

2 Dr. Hornberger, why don't we proceed?

3 DR. HORNBERGER: Thank you. Good morning.

4 Chairman Meserve and Commissioners.

5 I'm George Hornberger, Chairman of the

6 ACNW, and with me are the other members of the ACNW

7 are Raymond Wymer, the Vice Chairman, Milton Levenson

8 and John Garrick. And we will be presenting several

9 things today.

10 As Chairman Meserve said, we will be

11 focusing on high level waste issues, the high level

12 waste issue resolution program and key technical issues. And we

13 will in fact be giving you some highlights from

14 several more recent letters.

15 I know that we have heard from the

16 Commissioners interested in our perspective on the

17 key technical issues. I may slip and use KTI for key

18 technical issue.

19 I will try for Commissioner Merrifield's

20 benefit to not use any acronyms, but --

21 COMMISSIONER DICUS: Did you give us a list

22 of acronyms?

23 DR. HORNBERGER: We try very hard not to

24 use very many at all. But I may slip and use things

25 like KTI, NRC and DOE.

1 COMMISSIONER MERRIFIELD: As long as you fully  
2 explain it.

3 I appreciate your consideration of my request.

4 DR. HORNBERGER: We also have at the end of  
5 our presentation observations from our review of the  
6 NRC research program.

7 I am going to start off and go through some  
8 of our information on the issue resolution and issue  
9 resolution process and the sufficiency review that we  
10 did.

11 The ACNW undertook our review in parallel  
12 with the staff. Of course we're a really small  
13 committee and so we had to choose -- pick and choose  
14 how we did our review and we basically decided to do  
15 what we refer to as a vertical slice review.

16 We picked four topics, each of us took a  
17 topic, and we focused on chemistry issues, on thermal  
18 hydrology, on saturated and unsaturated and on TSPA.

19 Basically, it was very similar to the  
20 review that we carried out for the -- I want to say  
21 VA off of the --

22 CHAIRMAN MESERVE: Viability.

23 DR. HORNBERGER: Thank you, I couldn't  
24 think of viability -- viability assessment.

25 At any rate, our focus in the review was on

1 the NRC staff and not so much DOE, and what we did was reviewed DOE's site  
2 recommendation documents but really with the backdrop  
3 of the NRC's issue resolution process and our aim was  
4 to evaluate staff's tools, guidance and their  
5 capability to performing views.

6 The main message -- main messages that we  
7 have from our review is that we basically think that  
8 the issue resolution process undertaken by the NRC  
9 staff has in fact exposed the important technical  
10 issues of DOE's work at Yucca Mountain.

11 The staff argued as you know that they  
12 think that DOE has obtained or they have agreed to  
13 obtain sufficient in-depth characterization in waste  
14 form information for the -- to make a license  
15 application and the ACNW does agree with staff's  
16 findings in that light.

17 We however do see that there is much of  
18 importance in the agreed to obtain category in that  
19 information.

20 For example, information on corrosion of  
21 alloy 22 as an example the effects of trace, metals  
22 like lead in waters on corrosion of alloy 22. That  
23 really demands some further in-depth information.

24 And so we do recognize that DOE will have  
25 to provide additional information.

1           Our observations on the staff capabilities,  
2 we think that the staff is in fact well equipped to  
3 conduct reviews of DOE products, and including  
4 possible license application.

5           We were I think quite impressed by the  
6 issue resolution process as part of our vertical  
7 reviews. Each of us attended I think at least one of  
8 the technical exchanges.

9           I think that we have told you before that  
10 we found these to be quite valuable. We think that  
11 the information exchange between the NRC and DOE was  
12 very good and these for the most part, the meetings  
13 that we attended we thought were very well run,  
14 organized and very effective.

15          Continuing on our observations, we think  
16 that in our review of the sufficiency, that the staff  
17 in conversations with us, private conversations, told  
18 us that they were using their integrated assessment.

19          They were integrating their assessment,  
20 that they were using risk insights that they had  
21 developed as part of developing the Yucca Mountain  
22 review plan. And we think that it's quite important  
23 in our letter to you.

24          In our letter to you, we urge that the  
25 staff make the Yucca Mountain review plan publicly

1 available as soon as possible and also the integrated  
2 issue resolution status report and we continue to  
3 think that the Yucca Mountain review plan is ready  
4 for public release and we urge the staff to expedite  
5 the release of the integrated issue resolution status  
6 report as well.

7         We think that -- we have a copy -- we have  
8 received a copy of the Yucca Mountain review plan --  
9 the draft Yucca Mountain review plan.

10         We have not yet had time to fully review  
11 it.

12         In fact, we are scheduled to have a  
13 briefing on the Yucca Mountain review plan by staff  
14 tomorrow as an initiation of our full briefing on the  
15 subject.

16         We will be looking for an illustration at  
17 the Yucca Mountain review plan as risk informed. And  
18 also we have asked staff that -- we thought that  
19 staff needed to clarify in guidance to the  
20 Department of Energy how conservatism, the  
21 appropriate uses of conservatism. And we will be  
22 looking at in particular these issues along with  
23 others as we review the Yucca Mountain review plan.

24         Let me go on and give some comments about  
25 -- having gone through this process for the --

1 looking at these issues for the -- our vertical  
2 slices for sufficiency comments, let me transition  
3 and go on and talk about our views on the status of  
4 the key technical issue, the KTI program.

5       We think that -- we had a briefing I think  
6 in January by the staff on key technical issue  
7 resolution process. We also have continued to be  
8 updated by staff informally since then.

9       We think that the nine key technical issues  
10 definitely capture the important technical aspects of  
11 the -- of Yucca Mountain and so we continue to  
12 believe that and not just on the basis of the four  
13 vertical slices that we did, but on the full briefing  
14 that we have had.

15       I suppose our one lingering concern, if you  
16 will, and this has been a long standing concern of  
17 the ACNW and that is that whenever -- it's true any  
18 categorization, by categorizing the key technical  
19 issues, we are always concerned about the cross  
20 linkages amongst the KTI's.

21       And we think we know from staff that they  
22 are working very hard on integrating at the subissue  
23 level and making sure that the KTI's are fully  
24 integrated, but we still want to keep tabs on that.

25       We think that the work is progressing in

1 the right direction, but we still have some lingering  
2 -- perhaps concerns is too strong of a word, I have  
3 concerns on the slide. But we want to keep tabs on  
4 that.

5 As you know, the key technical issue  
6 resolution process resulted in 293 agreements between  
7 the Department of Energy and the NRC.

8 As I said, we think that the issue of  
9 resolution process, these technical exchanges where  
10 the agreements were made worked in general, they  
11 worked amazingly well. We think that this was a very  
12 sound process.

13 Of the two hundred ninety three agreements,  
14 when we were briefed at the meeting, we asked staff  
15 about some further refinement on these as to how many  
16 of these were really required DOE to do significant  
17 work.

18 DOE had given us their quick breakdown and  
19 DOE had said that there were 11 issues that they saw  
20 for testing -- that required testing analysis and 41  
21 that required further analyses.

22 Many of the rest of the agreements that the  
23 DOE categorization, they had, for example, 188 of  
24 them in documentation, and it was really more along  
25 those lines.

1           The NRC staff subsequently provided us with  
2 their thinking about -- their categorization.

3           At the first level, they thought that  
4 something on the order of 65 percent of the 293  
5 agreements were basically for documentation.

6           But the areas where there were considerable  
7 effort required by DOE were in a waste package -- the  
8 analysis waste package, the analysis of igneous activity  
9 effects, the performance of barriers and also  
10 demonstration of model confidence.

11          These agreements do vary widely in scope.

12          We don't -- the ACNW was not tremendously  
13 startled by the number, 293. We don't see this as a  
14 huge stumbling block. In fact, we believe the  
15 resolution process is working, that we should expect  
16 to have these kind of agreements in a first of a kind  
17 repository design like this.

18          And as I said, many of these are  
19 documentation for DOE to provide data bases that are  
20 already in existence. Some of them are for work and  
21 in fact some of them are for work that will very  
22 likely go into the performance confirmation period.

23          For example, there is no reason that I  
24 think we would even want DOE to stop doing testing of  
25 alloy 22 when they submitted a license.

1           It just didn't make sense. We should  
2 continue to collect information. And if we learn more  
3 in a performance confirmation period, that's so much  
4 the better.

5           We were asked to give some thought to what  
6 we considered to be the most important of the key  
7 technical issues and I will give you the ACNW's top  
8 four, that they are not rank ordered.

9           They are not the product of a deep  
10 systematic analysis. Rather, they are the product of  
11 our experience in reviewing all of these issues and  
12 basically our knowledge -- our belief as to how NRC  
13 and DOE need to proceed.

14          And really of course they are based on a  
15 lot of knowledge that we have about subissues beneath  
16 the key technical issue level.

17          The other thing that I would say is that  
18 each of these is I think different from the other,  
19 that is, that they're -- that each of them didn't  
20 appear on our list for exactly the same reasons. So,  
21 I'll try to give you a little bit of background as to  
22 why each of these appears on the list.

23          The first one we have is the container life  
24 and source term and I think that that one is pretty  
25 obvious, that the DOE safety case relies relatively

1 heavily on the performance of the barrier and there's  
2 considerable information that we need to get on  
3 things like corrosion of alloy 22, the long-term  
4 persistence of passive films to avoid corrosion,  
5 things like that.

6         And so, I think the container life and  
7 source term in terms of being an important KTI is, I  
8 think, pretty obvious.

9         The second one that appeared on our list is  
10 igneous activity.

11         This one I think appears on our list  
12 because it is going to be an issue that has to be  
13 addressed for -- certainly for public confidence.

14         It's an issue that has come up, the NRC  
15 staff and in conjunction with the staff at the Center  
16 for Nuclear Waste Regulatory Analyses have pushed  
17 DOE, that is, they have continued to ask DOE to  
18 provide information on igneous activity.

19         And, in truth, I think that DOE basically  
20 put these studies on a back burner. They had other  
21 things going. They knew that they were, I think,  
22 going to have to provide this information. But it's  
23 been relatively recent that they have made agreements  
24 with the NRC staff to provide such information.

25         I think that these agreements in my

1 estimation are appropriate and they are appropriately  
2 listed as several of them as in closed pending, that  
3 is, DOE provides the requisite information.

4 I think that this will be sufficient. DOE  
5 should be able to provide information sufficient for  
6 a license application.

7 The third one is listed as the unsaturated  
8 and saturated flow under isothermal conditions and  
9 although the Department of Energy, under their  
10 current analysis does not list this as one of their  
11 most important aspects of their safety case, we know  
12 that -- we all know that water is quite important,  
13 both from the standpoint of being the agent to  
14 dissolve or to corrode the canisters and the waste  
15 form itself and also to transport the radionuclides  
16 downgrading to the accessible environment.

17 And so it's hard to think about geological  
18 repository without thinking that this saturated and  
19 unsaturated flow is not an important consideration.

20 The final one on our list is total system  
21 performance assessment and that's obvious. This is a  
22 critical tool for the integration of the KTI's as  
23 well as for establishing the safety case.

24 This was one of our vertical slice issues  
25 and John Garrick is going to go into this in more

1 detail because I think that it will give you some  
2 insight not only on to our vertical slice approach,  
3 but give you a feel for why we think that this issue  
4 belongs on our top four. And if you like, we can  
5 just proceed. If there are questions, we can break  
6 at any time.

7 CHAIRMAN MESERVE: Why don't we hold the  
8 questions until the end of the presentations?

9 Dr. Garrick?

10 DR. GARRICK: Thanks, George.

11 If your exhibits are numbered like mine, we  
12 are on number fourteen. Is that correct?

13 I would like to talk about the vertical  
14 slice review we did of the performance assessment  
15 activity. I should say that we spent a good deal more  
16 time studying the DOE documents and its performance  
17 assessment than we did of the staff's, but we did  
18 spend enough time to form some important opinions,  
19 which we will share with you.

20 The underlying drivers for the vertical  
21 slice review as far as the performance assessment was  
22 concerned are exhibited on Exhibit 15 and they  
23 include being focused very much on what are  
24 considered to be the principal drivers of  
25 performance.

1           It's a massive undertaking as you  
2 know, and one of the greatest challenges in reviewing  
3 a study such as this is being able to be focused and  
4 be satisfied that you are moving in the right  
5 direction as it relates to safety, as it relates to  
6 performance analysis.

7           So we very much looked at what the bottom  
8 line results were and tried to, as best we could,  
9 first satisfy ourselves that those results made  
10 sense.

11           And then second, peel the onion so to  
12 speak, backwards and satisfy ourselves that they  
13 evolved in an appropriate manner.

14           The second item here on this exhibit is the  
15 extent to which results are risk informed and  
16 evidence-based.

17           The one aspect of the regulatory process  
18 that is undergoing substantial change is the  
19 transition to risk informed process. And therefore  
20 we decided that it might be very useful to use this  
21 particular vertical slice as some sort of a measure  
22 of what kind of progress we are making and how DOE  
23 and NRC are interpreting the risk informed concept  
24 and I'll have much more to say about that.

25           An issue that we have talked about before

1 with you and that is very important and something  
2 that is sometimes as abstract and complicated as a  
3 risk assessment or a performance assessment is the  
4 matter of transparency, how visible is the work, how  
5 understandable it is, how traceable it is.

6         And this is all essential in being able to  
7 defend the results and we certainly were looking at  
8 that.

9         The main message, Exhibit 16 of our review  
10 is that we are convinced that the TSPA is pretty much  
11 the backbone of the safety case. It is the one place  
12 that things are tied together.

13         And as I like to describe it, it is the  
14 place where the so what question is dealt with.

15         There are hundreds, perhaps thousands of  
16 individual analyses that are performed. Some of them  
17 are performed on a conditional basis.

18         Some of them are performed with a very  
19 restricted set of boundary conditions. And so, the  
20 most important issue that faces people in reviewing  
21 one of these is to put all of these in context and  
22 that's what a risk assessment is supposed to do.  
23 It is supposed to answer the question, what is risk?

24         So what we did spend a considerable amount  
25 of time in that arena for the reasons I have stated.

1           The other message here is that the  
2 performance assessment provides one of the missing  
3 links of the key technical issue list and that is how  
4 do they relate to each other and how do we make  
5 judgments as to their relative importance.

6           And of course as is the case here, it's not  
7 so much the integration at the level of the KTI as a  
8 descriptor, but the subissues associated with the  
9 KTI's and the more detailed structure behind the  
10 KTI's is where you begin to see the alignment with  
11 issues and algorithms and analyses that are actually  
12 performed in the total performance assessment.

13           Exhibit 17, and continuing with the main  
14 message of our review, was that we were very anxious  
15 to get a better handle on the two performance  
16 assessments, the one developed by the Nuclear Regulatory  
17 Commission and the one developed by the Department of  
18 Energy.

19           And I think it's important here to fully  
20 appreciate the different perspectives of these two  
21 models.

22           DOE, of course, is faced with building  
23 models from the ground up that are responsive to the  
24 regulatory requirements, whereas, the NRC model is --  
25 has to have some -- to have some capability to

1 independently analyze specific phenomena and specific  
2 events and features and processes.

3 But it's primary purpose is to evaluate,  
4 confirm the results of the licensee's analysis. And  
5 therefore you would expect the models would be  
6 different, which is quite healthy, and you would  
7 expect that the emphasis would be difference in the  
8 models.

9 Now, there's a -- there's not many subjects  
10 that are more controversial than risk assessment,  
11 performance assessment, particularly if by  
12 performance assessment you mean probabilistic  
13 performance assessment. And it's not a discipline  
14 that has been around long enough to establish an  
15 intricate set of standards by which you can measure  
16 its quality. So, it's pretty much at this point a  
17 case-by-case review.

18 And the ACNW is very much a supporter of  
19 the risk assessment thought process, the quantitative  
20 risk assessment thought process and probabilistic  
21 risk assessment thought process and therefore of the  
22 probabilistic performance assessment thought process.

23 We think it is essential to deal with the  
24 questions of how to importance rank issues. But there  
25 are some things that are very fundamental and

1 important to qualifying a performance assessment.

2 We list a few of those here.

3 The first one is that the performance  
4 measures need to be well defined. Well, the  
5 performance measures are for the most part defined in  
6 the regulations. And as we know, there are three NRC  
7 performance measure, the individual protection  
8 requirement, the ground water protection requirement  
9 and the human intrusion.

10 And in the EPA adds to that the time and  
11 magnitude of the peak dose and the performance assessments  
12 are addressing all of the -- all of these issues.

13 Now, the regulations do not require a  
14 performance assessment except for the individual  
15 protection requirement, but the performance  
16 assessments are being employed to address the  
17 questions, or at least the elements.

18 Analysis models are realistic.

19 This is maybe one of the most discussed and  
20 debated attributes of the performance assessment or  
21 the risk assessment.

22 The view here is that if the results are not  
23 realistic, if you don't have as a benefit of the  
24 decision-making process, the real expert's best shot  
25 of what they really believe to be the risk, then you

1 don't have a baseline from which to view the  
2 application of conservatism or what have you.  
3       So, it's a calibration process and that in  
4 one sense is why risk assessment was invented -- was  
5 not to be a conservative analysis, but to be an  
6 effort that gives on the basis of an integrated set  
7 of algorithms and analyses, an estimate of what is  
8 believed to be the real risk.

9       And of course that means inevitably  
10 addressing of uncertainties, results need to include  
11 uncertainties.

12       We talk about the quantification of the  
13 uncertainties and that quantification is generally  
14 done in the form of probability distributions about  
15 the critical measures to convey exactly how much is  
16 known and how much is unknown about the parameters  
17 that we have chosen as our measures of risk.

18       The other thing we have talked a lot about  
19 is the concept of analyses being evidence-based as  
20 opposed to assumption based.

21       And what we have seen in the different  
22 generations of the risk assessment is an encouraging  
23 progression from assumption-based analyses to  
24 evidence-based analyses, and it is inevitable that  
25 you will never escape having to make assumptions on

1 any model.

2       You can do the modeling in such a way that  
3 that dependency is reduced with experience and with  
4 gathering the site characteristic information.

5       And then in the final analysis, there are  
6 assumptions that have been to be made. Those  
7 assumptions have to be defended.

8       Our conclusions, we have been quite  
9 favorable in our review of the NRC's performance  
10 assessment.

11       We think it is adequate as a confirmatory  
12 tool.

13       It is different than what DOE has to do.

14       It has some advantages over the TSPA, that  
15 is to say, that DOE's performance assessment in that  
16 it has flexibility to look at issues such as the  
17 consideration of different scenarios and the  
18 examination of sensitivities and what have you.

19       And since it generally is a simpler model,  
20 it provides some efficiencies for doing that. There  
21 are improvements that are continuing and we have  
22 talked about those to some extent in the past.

23       Now, as far as the TSPA site recommendation  
24 we observe here on our conclusions that DOE  
25 complexity inhibits confidence in the results. And again I have to

1 point out that what we are focusing on here, among  
2 other things, is the extent to which risk informs the  
3 safety case.

4       And I think that that's very important to  
5 understand.

6       In order for it to be a risk informed  
7 analysis, the assumptions set has to be reasonably  
8 consistent, particularly those that are the important  
9 contributors to the risk.

10       By consistent, that is to say you can't  
11 have some assumptions that are probabilistic - have a  
12 probabilistic character, and other assumptions that  
13 are bounding if in fact these are as assumptions that  
14 are important to the bottom line results and satisfy  
15 yourself that is indeed risk in base, and there is  
16 some of that.

17       There is a mix of conservative and  
18 nonconservative elements. It's not always obvious  
19 that some of the elements that have been identified  
20 are indeed conservative or nonconservative.

21       Examples of conservative elements, and  
22 again, we focus pretty much on the -- more on the  
23 first line of defense, namely the waste package than  
24 we did on the backup defense, namely the natural  
25 system although we did some review there for sure.

1           But in the case of the first finding, the  
2 SPASR had some very -- what appears to be  
3 conservative assumption having to do with the  
4 degradation rate of the waste package. And these  
5 were locked up in the corrosion model that was used  
6 that made some very simplifying assumptions about the  
7 waste -- or the chemistry inside the waste package,  
8 the transport, and so forth.

9           And the exclusion for example of in package  
10 transport packs and not taking into account the  
11 secondary phases of corrosion, that is, to say when  
12 we had our workshop on engineered barriers, the point  
13 was made very emphatically that one of the most  
14 important aspects of the science of corrosion is the  
15 role of the corrosion products and how they enter  
16 into the degradation process of the facilities.

17           Well, the SR model does not take into  
18 account these secondary formations, does not take  
19 into account the possibility of hold-up time might  
20 come from reducing chemical environment in the waste  
21 package, and so on. These are just a couple of  
22 examples.

23           Another one might be the assumptions on  
24 solubilities of critical radionuclide in the case of  
25 the site recommendation TSPA, there was a high

1 solubility assumed for neptunium. It is not an  
2 important contributor to the dose during the time of  
3 compliance period. It is a very important contributor  
4 with respect to the time and magnitude of the peak  
5 dose.

6         Also on the disruptive case, the igneous  
7 activity case, there were some assumptions that  
8 really were contrary to what would be an approach  
9 that you would take if you were looking at this as a  
10 risk assessment and these had to do with the biosphere  
11 dose conversion factors and the assumption of such  
12 things as the wind direction that was a hundred  
13 percent of the time towards the critical group, and  
14 also some assumptions about the ash and erosion rates  
15 appeared to be quite arbitrary and quite conservative.

16         On the other hand, there are some other  
17 assumptions and other issues that were not  
18 necessarily conservative and these had to do  
19 with such things as the treatment of a couple of  
20 processes by which we mean the interaction of  
21 mechanical, chemical, hydrogeological and thermal  
22 processes at the individual analysis level and it  
23 appeared that these processes were addressed quite  
24 independently.

25         But in the abstraction process, and the

1 abstraction process is the transition from these  
2 individual analyses models and process models to the  
3 performance assessment.

4 In that part of the analysis, I call that  
5 kind of a mapping process from the individual models  
6 to the risk assessment, these were somehow combined,  
7 these coupled processes. And it's not clear how they  
8 were combined and we don't know what the impact was,  
9 conservative or nonconservative, but it's something  
10 that needs to be addressed.

11 But modeling abstracting process in general  
12 is something that has been of great interest to the  
13 Commission staff and to us and how that works, and  
14 there's still a number of questions that relate to it  
15 as it pertains to the establishment of a risk  
16 perspective.

17 And another area where it is not obvious  
18 that they're conservative is in the effectiveness and  
19 interaction of multiple barriers.

20 So those are what we mean when we talk  
21 about assumptions, a mix of conservative, and so on.

22 On Exhibit 21, we talk about the linkage  
23 between assumptions and supporting evidence lacks  
24 transparency. And there is a number of analyses  
25 performed where conservative analyses are made to

1 look at performance under different conditions.

2 But they are not accompanied in as many  
3 instances as we think they should be with the  
4 supporting information for making those analyses.

5 And so, the bottom line is that from a risk  
6 perspective, the margins of safety are obscured and  
7 it does not in general past the test of a risk  
8 informed presentation.

9 And as we say on Exhibit 22, therefore it  
10 does not answer the question of what is the risk.

11 Now, the good news is that there appears to  
12 be full recognition of this on the part of the  
13 Department of Energy and the documents which we have  
14 not reviewed in detail but we have had access to that  
15 followed the TSPA-SR are addressing most of these  
16 issues that we have identified if not all.

17 They are taking a much harder look at  
18 structuring the model to be more realistic. They are  
19 paying a great deal more attention to things like  
20 radionuclide solubility and the treatment of it on  
21 the basis of what the evidence can support. And  
22 therefore treating it in many cases probabilistically.

23 And so, the supplemental science and  
24 performance analysis report that you have heard  
25 about, there are a couple of other reports, a site

1 evaluation report, there is a technical update  
2 report.

3       These are all reflecting acknowledgment, if  
4 you wish, of the shortcomings of the site  
5 recommendation TSPA and addressing the issues. And  
6 we'll have to report to you later as to just how  
7 complete and successful they are.

8       So I think that -- you know, I haven't --  
9 we wrote you a letter on this and we didn't  
10 articulate the perspectives here as well as we would  
11 have liked to and I have been thinking about that  
12 since.

13       And in the middle of the night, I finally  
14 came up what I think is, what I call a singular point  
15 that I am trying to make and that the Committee is  
16 trying to make in their letter.

17       Let me just read it to you and I think it  
18 clarifies where we are and where we're coming from.

19       "The vertical slice review of the TSPA-SR,  
20 and now we are talking about the Department of  
21 Energy's total system performance assessment resulted  
22 in two overarching findings -- And this is not on  
23 your view graphs.

24       First, there is considerable evidence that  
25 DOE safety case for the proposed Yucca Mountain high

1 level waste repository can be developed to meet the  
2 prescriptive requirements of the regulation.

3 I chose the word prescriptive.

4 Some might choose the word deterministic or  
5 whatever.

6 But I think that that's an important  
7 observation that maybe we didn't articulate as  
8 succinctly and clearly as we should have in our  
9 report.

10 The second one and the one that's the basis  
11 for most of what we have been saying is however in  
12 the opinion of the Committee, the TSPA site  
13 recommendation does not risk inform the safety case  
14 in the manner of the traditional meaning of  
15 quantitative risk assessment."

16 And that says its as well as I can say it  
17 at this point.

18 So what does that mean with respect to our  
19 recommendations?

20 Well, it just sort of turns the findings  
21 around and suggests that the NRC take whatever action  
22 they can to encourage corrective action. And on  
23 Exhibit 23, we start delineating those.

24 And we say the NRC should ensure that DOE  
25 performs realistic analysis and maximizes the extent

1 to which those analyses are evidence-based as opposed  
2 to arbitrary assumption based, realizing that there will  
3 always be assumptions.

4 That the NRC ensure that DOE improves the  
5 traceability of the analyses.

6 There's a massive number of documents.

7 You have to go way beyond the performance  
8 assessment itself to provide the linkage that's  
9 necessary to understand what goes on. And I think  
10 that there is some great opportunities for  
11 improvements in that area.

12 The third thing we have here is abstracts,  
13 ensure that the abstract is a simplified model.

14 This analyses in our opinion lends itself  
15 very nicely to a simplified physics based model. And  
16 the reason we say this is there is some 250 to 300  
17 different fission products and several dozen  
18 actinides and if we had to calculate the  
19 dose of all of them, a simplified model might  
20 constitute an overwhelming task.

21 But when it turns out that only three or  
22 four of these dominate the risk, it seems to me that  
23 it manifests a path that one could take to develop a  
24 highly simplified, but very transparent model of why  
25 things are what they are and how the barriers enter

1 into their contributions to risk.

2           And so, we say as a final recommendation  
3 here that we believe that the TPA code, that is to  
4 say the NRC code, should be used principally to  
5 establish credibility of the analyses that becomes a  
6 part of any license application and in such  
7 particular areas of sensitivity analysis, the  
8 enhancement of realism and the quantifying of  
9 uncertainties.

10           And so that's kind of where we are.

11           We look forward to reviewing the post SR  
12 documents and look forward to reporting to you how  
13 some of these issues that we have identified have been  
14 handled.

15           Now, I'm just going to go from here since  
16 you want to hold on the questions to our next  
17 presentation -

18           CHAIRMAN MESERVE: I wondered if they don't  
19 want to --

20           Why don't we finish the research and then  
21 we'll do a round of questions?

22           DR. WYMER: In anticipation of the large  
23 interest in the topics you have just heard discussed,  
24 we have kept the research presentation I hope brief  
25 and maybe we'll allow enough time for discussion, but

1 as you know, we review and report annually on the  
2 research activities within the NRC and we have just  
3 finished writing a letter on our deliberations, which  
4 you have a great deal more detail to you about the  
5 research program and what we think about it, that  
6 we'll be able to give you here this morning in the  
7 time allotted.

8         We have based our report to you on  
9 presentations that we have heard from the staff  
10 during the past year on the report written by an  
11 expert panel that the report came out just this past  
12 summer on discussions that we have had with the  
13 Center for Nuclear Regulatory Waste Analysis, both  
14 members of the center came here and we have gone down  
15 there once during the year to review programs.

16         Our review down there was mainly focused on  
17 the interest to the Yucca Mountain repository and  
18 igneous activity for example and source terms. And  
19 we did sponsor a workshop on the research program  
20 this past November which we thought was useful in  
21 helping to identify research needs and there was a  
22 great deal of discussion on the general philosophy of  
23 research that came out during the course and what  
24 research should be done by the NRC that came out  
25 during this workshop.

1           The focus of the programs are two areas  
2 involved. One is the work sponsored by the Office of  
3 Nuclear Regulatory Research. The other is work  
4 sponsored by the Office of Nuclear Materials Safety  
5 and Safeguards.

6           The latter is research work in our view of  
7 what research is although, it is not formally called  
8 research and it is in support primarily over the  
9 Yucca Mountain -- almost exclusively with the Yucca  
10 Mountain repository.

11          The work by the nuclear regulatory Research  
12 organization, the Office of Nuclear Regulatory  
13 Research has emphasized modeling of flow on  
14 radionuclide transport and a very good program has  
15 been put together in this area.

16          I had the opportunity to attend a meeting  
17 of the participants in this program --  
18 representatives from U.S. Geological Survey, Sandia Laboratories,  
19 and the Center, and it was my view that it was -- the work is  
20 of high quality and it is -- is directed an  
21 appropriate question because transport is fundamental  
22 to dose almost throughout the entire business that  
23 the NRC is concerned with.

24          And it served to bring together and  
25 integrate the activities in this area of the

1 participants so that they all understood what was  
2 being done in the various parts and potential  
3 duplication was avoided and information was  
4 exchanged.

5       So the work that's being done there is  
6 good.

7       We did address the issue at some length,  
8 both in the workshop with working group and among  
9 ourselves of prioritization of research.

10       We have had presentations from the staff on  
11 research prioritization and in our view that  
12 addresses to a point the question of are we doing the  
13 right research? And my short answer is, yes, at the  
14 moment we are doing the right research. We are just  
15 not doing enough of it.

16       But what's being done is directed at a very  
17 important problem.

18       But we do believe, and I anticipate  
19 questions on this point, that there's too little  
20 anticipatory research, research that looks ahead to  
21 the possible future of potential problems that might  
22 arise, not yet surfaced, but where there might be  
23 indications that there is a potential for problems.

24       And the anticipatory research would try to  
25 see what some of those problems might be and they

1 might be of such a nature that the lead time to solve  
2 the problems would be too long for a timely solution,  
3 if you waited until the problem was certain, until it  
4 had surfaced and there was a clear understanding of  
5 what the problem was.

6       So that's the nature of anticipatory  
7 research, that you try to anticipate the problems and  
8 get a start on them so that you are not caught short  
9 and don't have the information when you need it.

10       We think that the -- and with respect to  
11 prioritization, that the analytical hierarchy process  
12 which is called the AHP process is a useful tool  
13 for setting priorities within the program as it's  
14 currently manifested in the research program, the RES  
15 activities, Office of Nuclear Research activities.

16       It's not very sophisticated and we believe  
17 it could be improved by more attention paid to  
18 decision-making, more formal decision-making  
19 procedures.

20       But we do not believe that any of these  
21 kinds of processes like the analytical hierarchy  
22 process can address the most fundamental issue with  
23 respect to prioritization and that is what's the  
24 split between the resources that are devoted to waste  
25 safety and reactor safety.

1           And it is our opinion that that's your  
2 problem, that the Commission level that that decision  
3 must be a policy decision.

4           And I've covered that slide.

5           So under observations -- I mentioned the  
6 office of regulatory research program, radionuclide  
7 transport, they have prepared a -- prepared a draft  
8 plan for that program.

9           It contains some 28 individual research  
10 projects, which is a large number, considering  
11 the resources they have to put on it.

12          The plan is well done.

13          I haven't a chance to go through it.

14          I think it's in final form or very nearly  
15 in its final form.

16          I have gone through the draft of it.

17          It's a comprehensive plan and should go a  
18 long way toward optimizing it at the moment the  
19 use of resources are available to RES.

20          In association with that, the NRC has  
21 joined a group formed by a memorandum of  
22 understanding between various agencies on modeling of  
23 transport processes, which is headed up by Bill Aug  
24 who gave us a presentation on that.

25          Bill is a current chairman of that activity

1 so that it's maiden efforts are guided by a chair  
2 from the NRC.

3         And that should be very useful and it  
4 should integrate a wide spectrum of activities that  
5 are taking place across many federal agencies to try  
6 to bring some uniformity into this complex issue,  
7 radionuclide transport.

8         And I have mentioned that we do think that  
9 there should be a modest compliment of anticipatory  
10 research.

11         With respect to the workshop, I would like  
12 to return to that, we had last November.

13         There were some lessons learned, there were  
14 a number of things that came out of that workshop at  
15 all levels from a very broad discussion of how NRC in  
16 general should conduct its research program down to a  
17 detailed list of specific research areas that was  
18 prepared by the workshop members, that they thought  
19 were worthy of pursuit.

20         It was far too long a list to -- for the  
21 NRC to tackle. And some of the issues were of less  
22 importance than others.

23         But one of the things that did come out was  
24 that there is a great deal of information, we  
25 believe, in the workshop and members believe

1 available at sites that have been closed or are  
2 presently undergoing decommissioning, information of  
3 the kind that would provide input to the transport  
4 modeling of studies.

5       There is a lot of samples that have been  
6 taken, a lot of analyses have been made. Additional  
7 samples and monitoring could be done on a very  
8 carefully selected basis for a couple of sites that  
9 had -- they were quite complex and had a lot of the  
10 attributes that play an important part in  
11 radionuclide transport and potential dosage to the  
12 public.

13       We can capitalize on that information and  
14 augment it with a modest additional effort by the  
15 research activity. And some of these others are sort  
16 of obvious.

17       We said that rather than NRC trying to do  
18 everything, they should certainly go out and look for  
19 what has been done exhaustively.

20       They do that.

21       I don't mean to say they don't do that.

22       But it should be a front-burner issue that  
23 they should keep current on what research is going on  
24 elsewhere. And where necessary, then maybe add to  
25 that research by carefully chosen studies.

1           We think that the limited resources that  
2 are available for research and NRC could be leveraged  
3 by collaboration and some of that is taking place and  
4 none of these things are new thoughts, but we want to  
5 emphasize the importance of the thoughts in this  
6 presentation.

7           And that collaboration both nationally and  
8 internationally with organizations that are doing  
9 research that are related to NRC's interest, these  
10 should be actively sought.

11           And then finally, we think that for the  
12 credibility that it brings to the research being done  
13 by NRC and for the recognition that it gives to the  
14 researchers and for the improvement of the work  
15 that's carried out, the research done at NRC should  
16 be peer reviewed, both by publication and peer  
17 reviewed high quality technicals journals and by  
18 panels and experts that would be brought in to  
19 perform peer reviews periodically of the work that's  
20 going on.

21           Finally, I will restate, I think that our  
22 view is that the nuclear regulatory research work  
23 that's supported right now is very high quality and  
24 it's aimed at appropriate, an appropriate problem,  
25 that's radionuclide transport.

1           The Nuclear Materials Safety and Safeguards supported work at  
2 the Center for Nuclear Waste Analysis is -- we think is very  
3 well managed, both here at the NRC and at the Center.

4           It's of high quality and it does address  
5 important issues and focuses on the Yucca Mountain  
6 problems and it has addressed issues that we think  
7 are at the heart of this NRC decision-making process.

8           That's what I have to say about that.

9           DR. HORNBERGER: That's our presentation.

10          So we can proceed to address any questions  
11 if you have them.

12          CHAIRMAN MESERVE: Thank you very much. As  
13 always, this has been a very helpful presentation for  
14 us.

15          Let me go quickly to the issue of what  
16 bottom line you would like to have us draw and I  
17 think that -- let me summarize what I think the  
18 bottom lines are as to the Yucca Mountain activity.

19          First I said the NRC's activities you are  
20 basically satisfied and on track and we are doing the  
21 things that we should be doing.

22          DR. HORNBERGER: Yes.

23          CHAIRMAN MESERVE: With regard to DOE, you  
24 have concerns in particular with regard to its  
25 performance assessment and it's risk based but that

1 you are seeing some progress by DOE in addressing the  
2 issues that you have raised?

3 DR. HORNBERGER: Yes.

4 And furthermore, you may have observed that  
5 the TRB -- the technical review board has also urged  
6 DOE to move in this direction.

7 So I think that we will also get some  
8 muscle from the DOE side.

9 CHAIRMAN MESERVE: You have indicated that  
10 the igneous activity KTI you believe is one of the most  
11 important KTIs, partly you did it because of the public  
12 conference issues.

13 I have just seen a recent letter from the  
14 NWTRB on that issue in which they state that they  
15 believe the NRC model for igneous activity may be overly  
16 conservative and it's a quote from the letter.

17 Have you looked into that model and given  
18 your views on conservatism versus realism?

19 Do you have any views on it?

20 DR. HORNBERGER: We just read that letter  
21 as well and unfortunately, I did not have time to go  
22 to the NWTRB site and get the documentation, so we  
23 have not yet had a chance to review that.

24 We did note that the TRB, who is not known  
25 for dismissing things out of hand, thought that -- or

1 thinking things that were too conservative.

2       They did note that in their letter, and so  
3 we think that we do have to look at this, we think  
4 that we have to take a deeper look to make sure that  
5 things are as they appear to be.

6       The NRC staff certainly are pretty up front  
7 about their assessment of the analyses that have been  
8 done and they recognize that there are simplified  
9 analyses for the reflection of the shock wave and the  
10 drifts, and so forth and so on.

11       So I don't think that the NRC staff or the Center  
12 staff would necessarily disagree that there are some  
13 conservative aspects of the model.

14       And in fact, I think that they also agree  
15 that there has to be further work done in this area.

16       CHAIRMAN MESERVE: Turning to the research  
17 presentation, this is an issue, as I'm sure you know,  
18 has been of great interest to the Commission,  
19 research more generally throughout the Commission.

20       Your slide 28 indicates that the allocation  
21 of resources between reactors and waste arenas needs a high  
22 level policy decision.

23       Could you tell me exactly what you mean?  
24 Is it your view that there is an imbalance in support  
25 between the reactor and the waste arenas or is that

1 that both need to be upped or how would you frame a  
2 policy issue that you think we need to address?

3 MR. WYMER: Well, one point is that we  
4 don't believe that the people in RES, for example,  
5 have the clout to make any decision as to how this  
6 split is made.

7 Therefore, it has to be made above RES and  
8 NMSS -- pardon me -- and so this kicks it up to the  
9 level of the Commissioners.

10 And so whether or not the split is  
11 appropriate is your decision.

12 You know, it's --

13 DR. HORNBERGER: Right.

14 We think that certainly the total research  
15 program in the of Office of Research is fairly  
16 resource limited or tightly resource limited.

17 And so it's not that we would say that  
18 reactor research is over-endowed.

19 I think that probably our concern comes as  
20 to how one can make readjustments, if readjustments  
21 are necessary.

22 And we don't see that the analytical  
23 hierarchy procedure will necessarily lead to  
24 adjustments, again, should they be necessary.

25 We certainly don't have the perspective on

1 important reactor research versus important  
2 waste-related research to decide whether those  
3 readjustments should be made.

4 Our concern is more if they -- if somebody  
5 judges that they do have to be made, how would they  
6 do it?

7 And it's hard for us to see how that would  
8 be done within the office of research itself.

9 MR. LEVENSON: I might add a comment that  
10 obviously this committee has a little bit of a bias,  
11 but historically, the allocation of funds between  
12 reactors and waste, we think was heavily weighted  
13 towards reactors properly.

14 There weren't any serious waste questions.

15 With Yucca Mountain coming up, we think  
16 it's time for a reassessment of the historical  
17 division and that could really only be done by the  
18 Commission.

19 MR. GARRICK: And I think the thing that  
20 really got us on this track is when we were briefed  
21 on the prioritization process and if you look at the  
22 details of the prioritization process, it is very  
23 evident that it emanated from a reactor research,  
24 thought process, not from a waste research thought  
25 process.

1           That the terms that are defined, the whole  
2 approach was pretty much geared to reactors and  
3 that's what got us to thinking that there needed to  
4 be some sort of a structure that was specialized to  
5 needs of the waste business and as a -- to provide  
6 insight on the research requirements for waste.

7           CHAIRMAN MESERVE: Can you be more specific  
8 about what sort of things that you would change in  
9 the prioritizations?

10          MR. GARRICK: Well, I think that the  
11 reactor prioritization was very much geared to what  
12 it takes to solve the such things as the unresolved  
13 safety issues and the safety problems associated with  
14 reactors.

15          The safety issues associated reactors was  
16 driving the prioritization, even when it was applied  
17 to some extent to the waste business.

18          And all we're suggesting is that the waste  
19 field is by very much different factors such as the  
20 end states, the final disposition of the waste and  
21 what have you.

22          Then are reactors, which is how do we  
23 reduce the core damage frequency, how do we reduce  
24 the frequency of occurrence of a large early release  
25 and so forth.

1           And those differences were not evident in  
2 the briefings that we received as to applying the  
3 example applications of prioritizing.

4           DR. HORNBERGER: Now, in fairness, the RES  
5 staff recognized this and a year ago, they had put  
6 forward suggestions for changing, making changes in  
7 these ranking numbers and which we supported and  
8 these were implemented and we were told by staff that  
9 the numbers game now, at least gets the waste related  
10 research to some level of comparability with reactor  
11 related research.

12           So this is all well and good.

13           We still don't think that that necessarily  
14 resolves the issue that I had mentioned as to how  
15 internal decisions can be made in terms of  
16 allocation.

17           We just don't have any confidence that that  
18 would be the right way, the expectation.

19           CHAIRMAN MESERVE: You mentioned that  
20 emphasizing you think that anticipatory research is  
21 missing.

22           Is there some specific areas that you have  
23 in mind where you don't think that there is  
24 sufficient work that's on the way?

25           MR. WYMER: Well, let me approach it just a

1 little different from a direct answer to that  
2 question and let's take the Yucca Mountain example  
3 and pose a hypothetical problem.  
4       Let's say that alloy 22 is found downstream  
5 somewhere, not to really meet the expectations or for  
6 some reason it doesn't guarantee the doses that DOE  
7 would like to see at the 18 kilometer site boundary  
8 and therefore you need to look somewhere else to get  
9 the safety margin that you want on the dose and so if  
10 you would -- and that's not out of the question in  
11 light of the -- of the relative recent invention of  
12 alloy 22 and the limited amount of work that's been  
13 done and the ten thousand year horizon which it has to  
14 survive and so let's just take hypothetically suppose  
15 that it fails and you might anticipate what, not with  
16 any assurance, but with some misgiving that it might  
17 fail.

18       So you say, well, maybe we need to do some  
19 anticipatory research because it will be downstream a  
20 ways before we learn that it's not adequate, if we in  
21 fact learn that, and therefore we have to take some  
22 protective steps.

23       Now, a couple of things that the DOE might  
24 propose might lead to situations where the NRC could  
25 not get its confirmatory -- confirmatory research

1 done fast enough in order to proceed with the license  
2 application, if they waited until the problem became  
3 obvious.  
4 And the kind of thing that would occur to  
5 me is, for example, maybe DOE is going to say we are  
6 going to step back and say we are going to  
7 investigate more closely this radionuclide transport  
8 or we are going to investigate more closely the  
9 problem of source term how much is released from a failed fuel  
10 element, fuel container.

11 What can we do there to decrease the dose  
12 that the boundary? What sort of thing will we  
13 propose? And it may be up to NRC to evaluate that  
14 proposal.

15 The kind of thing that DOE might say and  
16 this is something that we actually mention in our  
17 chemistry white paper a while back is that well, you  
18 might -- let's say look at the elements that are the  
19 key elements, neptunium, plutonium, iodine and technetium.

20 So these are the elements that you would  
21 worry about or concerned about reducing the rate of  
22 transport.

23 All of these have a variety of chemical  
24 states and you can say that it would be possible in  
25 the repository, and this is all hypothetical, it

1 would be possible in the repository to change the valent  
2 state of these elements.

3 Neptunium is a monovalent ion, moves very  
4 rapidly through the environment in the modeling  
5 studies

6 The protactinium ion is a monovalent ion moves very  
7 rapidly through the environment relative to other things.

8 The plutonium is tetravalent, tends to form colloids moves fairly  
9 rapidly because it's not ionic, through the environment.

10 All you would have to would be to reduce  
11 these things chemically from a higher balanced state  
12 to a lower balanced state you would expect that you  
13 would have a dramatic reduction in the rate of  
14 transport and the reduction mechanism hypothetically  
15 might be due to all the iron that's present in the  
16 repository, both in the waste container and the bolts  
17 that hold the ceiling in place and all kinds of  
18 material at construction and this could potentially  
19 reduce these elements at lower valent state and they  
20 would move more slowly.

21 That's one hypothetical type of  
22 anticipatory research. And another one is and give  
23 one more example and I'll quit, is you could work on  
24 the source term.

25 You can say what can we do -- DOE can say

1 what can we do to change the rate at which the  
2 package releases these elements that we are concerned  
3 with providing the dose?

4 A thing that has been proposed is you might  
5 put uranium dioxide in the waste containers. Get  
6 your uranium dioxide as the form of the fuel.

7 You put it uranium dioxide in there and  
8 therefore there's very little driving force for the  
9 fuel to dissolve. It's already saturated with the  
10 solution products.

11 And from a totally  
12 different point of view, the Department of Energy is  
13 looking for some way to get rid of 700,000 metric  
14 tons of UF<sub>6</sub>, the uranium in UF<sub>6</sub>.

15 It turns out that that's just about the  
16 amount that you would need to fill out waste  
17 containers, with 70,000 metric tons of waste.

18 So the point of setting that example is to  
19 say when you look upon anticipatory research, you  
20 ought to look broadly, you ought to cast your net a  
21 little broader than is customary and look afield at  
22 what's going on around you to see if there are  
23 symbiotic things that is can be introduced in this  
24 anticipatory research.

25 MR. MESERVE: My final question is just to

1 follow up on your slide, talking about slide 31 in  
2 talking about perhaps abstracting more information  
3 from the waste facilities than we are.

4 Now, I know from a licensee point of view  
5 that if you have a problem, there is hundreds of  
6 thousands of dollars that are spent on drilling wells  
7 and being able to assess the ground water  
8 circumstances and chemistry and so forth fed into its  
9 often 3D models. But that whole effort is largely  
10 driven by it not being a research project.

11 You try to use the standard models.

12 You try not to do anything that would be  
13 viewed as cutting edge because there are questions  
14 that can be asked about it.

15 You are trying to demonstrate that you are  
16 handling the ground water circumstances in a way that  
17 is going to be acceptable for compliance purposes.

18 DR. HORNBERGER: Environmental lawyers do  
19 this to us, right?

20 CHAIRMAN MESERVE: That's right.

21 The environmental lawyers do this  
22 traditional stuff so you can get it through the  
23 regulatory agency. And I'm curious about what  
24 additional information you think you can extract from  
25 those kinds of sites, given what the licensees are

1 doing is a kind of different objective than research  
2 objectives.

3 MR. WYMER: It should be possible to get  
4 quite a bit of information about the movement of  
5 radionuclide to a wide spectrum of geological  
6 settings because there are a lot of sites in a lot of  
7 different parts in the country that have radioactive  
8 contaminations that is in fact moving, groundwater is carrying it  
9 through the environment.

10 So it should be possible to check the  
11 models a lot better by going after this kind of  
12 information which is already there to a certain  
13 extent and which could be supplemented probably  
14 fairly modestly, certainly a lot easier than  
15 instituting a new program to try to seek out this  
16 kind of information and that's what was meant there.

17 DR. HORNBERGER: Some of the participants,  
18 at least one or two of the participants in our  
19 workshop were familiar with work that US Geological  
20 Survey has done even at Superfund sites. So even  
21 where all of these kind of restrictions that you lay  
22 out apply and yet by participating in the data  
23 collection, they find that the scientists can use the  
24 information, not necessarily in ways that make their  
25 way to the regulators, but sort of off to the side,

1 in addition, over and above meeting the clean-up  
2 requirements and they found that to be very effective  
3 in their own research. And so I think that --

4 MR. LEVENSON: I think that, as you  
5 mentioned, generally the data is collected for a  
6 specific purpose, used for a specific purpose and  
7 tends to die there.

8 And our view is that collection of all of  
9 that data in some sort of central way gives you a  
10 much broader view and can be valuable for other uses  
11 without huge investments of funds as you would have  
12 to --

13 CHAIRMAN MESERVE: Thank you.

14 You're next.

15 COMMISSIONER DICUS: Thank you.

16 Well, based upon the bottom lines that the  
17 Chairman started out with and my own observation, the  
18 comments you have made, et cetera, you seem to  
19 believe that the NRC staff is doing what they're supposed to be doing  
20 working in the right direction.

21 If I heard you right, you're pleased with  
22 the Yucca Mountain review plan,  
23 you're pleased with the resolution  
24 processes for the KTI's, et cetera?

25 DR. HORNBERGER: By the way, we have not

1 reviewed the Yucca mountain review plan formally.

2 COMMISSIONER DICUS: What you know about  
3 it.

4 DR. HORNBERGER: We are getting a briefing  
5 tomorrow and that will be our first briefing.

6 COMMISSIONER DICUS: Okay.

7 Then you might be leading right into my  
8 question.

9 You have expressed also your concern about  
10 the adequacy of what we might see in a DOE license  
11 application.

12 Although you think that might be improving. And  
13 at least in some ways and I want to come back to that  
14 question of what is risk in a little bit.

15 We are in a very unique situation with this  
16 entire process, the first time to do something of  
17 this magnitude and of this type.

18 And I know we have some concerns about  
19 where the line is between our role as a regulator and  
20 that we are not a consultant to DOE, even though we  
21 are providing documents. We do that in other  
22 licensing arenas.

23 Of course, if you haven't looked in detail  
24 at the review plan, then perhaps you're not quite  
25 ready to answer this question. But is some of the

1 inadequacies that you are concerned about with might  
2 be in the license application from DOE, what have we  
3 not provided or should provide as a regulator in that  
4 regard?

5 DR. HORNBERGER: In fact, we are not ready  
6 to give a definitive answer to that question.

7 But this is exactly the framework that I  
8 think we are going to use in our review of the Yucca  
9 Mountain review plan.

10 Having said that, our indications are that  
11 the staff have in fact really risk informed the Yucca  
12 Mountain review plan. We believe that, now again, we  
13 haven't looked at it in detail.

14 But from our interactions with them as they  
15 were developing it, we think that's the direction  
16 they have gone. But we will be addressing exactly the  
17 questions that I believe is part of our viewing.

18 COMMISSIONER DICUS: That's fair enough.

19 I'll look forward to that.

20 I want to go now to the issues that you  
21 have raised, it's in your slides. It's also in your  
22 September 18 letter on the question -- the comparison  
23 of DOE's TSPA-SR is driven more by an attempt to  
24 demonstrate compliance with the standards than by the  
25 need to provide an assessment designed answer what is

1 risk.

2           And then we in November responded to that  
3 statement -- and DOE responded to it and said the DOE  
4 is able to use the flexibility afforded by the NRC's  
5 risk informed performance-based regulations to  
6 develop a realistic performance assessment or to  
7 introduce conservatism.

8           As long as their approach is able to  
9 demonstrate compliance, the staff has no basis to  
10 require DOE to use any particular approach.

11           And you're very much familiar with that  
12 response, et cetera. So based on this, your concern  
13 seems to remain the same in regard to what you talked  
14 about today.

15           So, is there a disconnect between what we  
16 are saying, what we are doing, demonstrate compliance  
17 to where you are going?

18           And if so, what is the disconnect?

19           MR. GARRICK: You want me to answer that?

20           DR. HORNBERGER: Sure.

21           MR. GARRICK: Well, I think that one of the  
22 things that we are saying is that while the language  
23 of the Yucca Mountain review plan, to the extent that  
24 we have seen it and the work that's been going on in  
25 the issue resolution process and including the

1 technical exchange meetings seemed to be very tuned  
2 in to dealing with issues, from a risk perspective.

3 This is the first time that we have really  
4 practiced this in this manner.

5 It's not only the first of a kind license  
6 application, but there is some first of a kind  
7 applications of techniques having to do with  
8 convincing ourselves that the process is risk  
9 informed.

10 And I know what you are saying and that is  
11 that if they comply with the regulations, what else  
12 is there?

13 And I won't answer this as a regulator, but  
14 as an analyst and say that I am a great believer in  
15 not relying totally on regulations for the  
16 demonstration of safety and I think that that's one  
17 of the attributes of the risk assessment thought  
18 process.

19 I think it's extremely valuable.

20 It does not necessarily anchor itself to  
21 regulations. It just keeps asking the question what  
22 can go wrong and how likely is it and what are the  
23 consequence. And I think that's an extremely valuable  
24 adjunct to the whole process.

25 So, I don't think it's criticism of the

1 regulations or a conflict between the issue of what  
2 is risk and the issue of compliance as much as it is  
3 an important tool for continually testing the  
4 compliance process.

5         And I think that we have seen on the  
6 reactor side and we have seen in many other  
7 regulations an evolution of the regulatory process  
8 that has been very much influenced by what we have  
9 learned from trying to be risk informed about these  
10 things.

11         So I don't have a real problem with it.

12         But as an analyst, if I'm going to be  
13 guided something, I'm frankly going to be guided more  
14 by trying to answer the risk question than I am by  
15 complying with the regulations.

16         COMMISSIONER DICUS: Okay.

17         And I don't necessarily disagree with you  
18 on that point. I think where I'm trying to go to is,  
19 and maybe when you do an in-depth of the review plan,  
20 you can give more feedback on whether or not that is  
21 sufficiently risk informed -- that the applicant or potential  
22 applicant can truly use it to begin to answer your  
23 question on the question that the Advisory Committee  
24 has on answering the issue of risk.

25         My question comes from being sure that we

1 are not that we are going off and that we are coming  
2 to some point together.

3       Okay. Let me ask about this integration  
4 across the KTI's.

5       Could you give me a for example?

6       I'm battling to -- I'm trying to understand  
7 what that means.

8       DR. HORNBERGER: Ray, do you have a ready  
9 example in terms of coupled processes? You know,  
10 we'll try to give you an example that isn't too  
11 technical. Ray tends to give chemistry lectures,  
12 but --

13       MR. WYMER: It's not all bad.

14       SPEAKER: I thought we were  
15 going to get through this without the word valiance.

16       SPEAKER: Go ahead if you want to.

17       DR. HORNBERGER: I think some of the things  
18 have to do with, for example, with the issues in near  
19 field interactions between the rock and water and  
20 waste products, separate from thermal effects because  
21 these are dealt with in the thermal hydrology area.

22       And again I don't want to say that these  
23 are not being considered by the staff because the  
24 staff is well aware of all of these things and they  
25 really are moving in what we think is the appropriate

1 direction. That is why I sort of cringed because I  
2 saw a concern on my slide. It's less than that. We  
3 just was to keep tabs on it.

4 COMMISSIONER DICUS: Are you comfortable  
5 that the staff knows what you are talking about here?

6 DR. HORNBERGER: Oh, yes, we have had all  
7 sorts of interaction with the staff.

8 MR. WYMER: The same thing comes to my mind  
9 has to do with the coupling process. We tend to list  
10 that our nine KTI's in their nice neat little  
11 separate categories, but in fact they do. The issues  
12 that arise in these individual KTI's do interact with  
13 each other.

14 And in some cases and the interaction is  
15 not necessarily carried across the boundary. We tend  
16 to discuss each of these KTI's in terms of their  
17 subissues and yet there are interrelations among  
18 them, everything is interconnected. And so with the  
19 kind of examples that would occur to me are those  
20 that have to do with coupling of processes and  
21 coupling of things across the KTI's.

22 COMMISSIONER DICUS: Slide 13, you noted  
23 that what you thought were high public confidence  
24 issue is that among the highest public confidence  
25 issues -- let me go back to slide 13 -- igneous

1 activity I think it was.

2 DR. HORNBERGER: Igneous activity? Yes, I  
3 think so.

4 I suppose if we were going in terms of  
5 public confidence, we might list transportation  
6 somewhere in there.

7 But I think that igneous activity.

8 Don't get me wrong, I think that that there  
9 are -- there are some definite technical issues that  
10 the NRC staff has raised that really need to be  
11 addressed and so I think that there is a need to  
12 address these and that's why it's on that.

13 COMMISSIONER DICUS: Okay. And you  
14 mentioned that the unsaturated and saturated flow  
15 that this was not high on DOE's list.

16 Is that a problem? Are there other  
17 examples?

18 DR. HORNBERGER: No, if you look at the --  
19 if you go all the way back to the viability  
20 assessment, it turns out that it was one of the  
21 critical issues for the Department of Energy.

22 And then -- well, what happened?

23 What happened is we got to alloy 22 and all  
24 of a sudden alloy 22 is robust enough so that the  
25 flow of water no longer appears as an important

1 issue.

2           Nevertheless, it is the vehicle by which  
3 radionuclides potentially get transported to the  
4 critical group and so we think that it can't be  
5 dismissed. And so, it has to appear on our list.

6           But it's not one of the top-ranked things  
7 in DOE safety case right now.

8           COMMISSIONER DICUS: Okay. Thank you very  
9 much.

10          CHAIRMAN MESERVE: Commissioner Diaz?

11          COMMISSIONER DIAZ: Thank you,  
12 Mr. Chairman.

13          Let me just go back on the issue of  
14 integration.

15          When I heard you talking about it, I  
16 thought you were talking about something other than  
17 couple processes. You were actually flip looking at  
18 the actual carryover or the connection between one  
19 solution for KTI and the other one and how they  
20 actually stack.

21          Is that correct, integration means every  
22 one of those issues and once you get to a resolution  
23 how they impact on the resolution?

24          DR. HORNBERGER: That is correct and that's  
25 really the context that we think is really important

1 from the total system performance assessment  
2 standpoint.

3 COMMISSIONER DIAZ: And couple process  
4 means something different.

5 DR. GARRICK: Those are the things that  
6 occurred to me.

7 COMMISSIONER DIAZ: I'm sorry.

8 I just wanted to make sure I understood.

9 Let me -- an easy question and then I'm  
10 going to have some fun.

11 First thing you talk about the adequacy of  
12 information and we have the 293 agreements that you  
13 thought were adequate.

14 Are there any particular areas where in  
15 this agreements that you believe we need better  
16 information? If so, do you know them or could you  
17 get back to us with this - what is any specific areas  
18 that you think that are weaker than others?

19 DR. HORNBERGER: Well, I think in general  
20 terms we certainly agree that the issue of the container  
21 license and there are agreements there for DOE to  
22 provide information on corrosion rates for alloy 22  
23 in particular and how the quality of waters affect  
24 that corrosion -- things like that.

25 These are, as you well know, these aren't

1 experiments that one does over a span of tree days  
2 that these take some time to develop. And so it's  
3 quite important for the information to be developed.

4 I also think there are some issues down the  
5 line for performance confirmation that need to be  
6 addressed.

7 CHAIRMAN MESERVE Yes.

8 DR. GARRICK: And actually that has a tie  
9 also with the research when we come from certain  
10 issues such as monitoring -- that's pretty much a  
11 wide open field and we are not only a thinking here  
12 of preclosure monitoring but postclosure as well.  
13 And not much has been done there.

14 To carry on with your comment,  
15 Commissioner Diaz, I think that if you  
16 look at the waste package itself and if you continue  
17 to take a position that the first line of defense is  
18 what we really want to be assured of that it's going  
19 to get us through the compliance period with a couple  
20 of exceptions, one is the contribution that comes  
21 from the igneous events and the other is the  
22 contribution that comes from defective waste  
23 packages.

24 But there it may turn out that there we  
25 will need to be a more mechanistic model if you wish

1 all the in package condition of the products.  
2       You heard Dr. Wymer talk about the  
3 implications of reducing environment rather than  
4 contributing to the holdup time of radionuclides and  
5 the current models that do not take much advantage of the in  
6 package conditions.

7       There is not really a transport model as  
8 the end package condition of the DOE TSPA is a  
9 saturated water environment, a condition that is not  
10 very realistic when it really comes to trying to deal  
11 with the question of how the waste mobilizes and  
12 combined with assumptions about aggressive water  
13 chemistry.

14       These are examples as I cited earlier of a  
15 departure from a risk informed approach.

16       And I think that if there is a desire to  
17 enhance the case of the first line of defense here  
18 namely the waste package, it's probably going to have  
19 to be considerably more attention given to the modeling of the end package  
20 conditions.

21       COMMISSIONER DIAZ: I understand. Thank  
22 you.

23       MR. LEVENSON: I might give a little more  
24 general comment or answer on this matter do we think  
25 more information is needed?

1 NRC doesn't design the repository.

2 We evaluate the DOE design.

3 We have not seen the final DOE design so  
4 that if there are significant changes, there will  
5 certainly be a request for additional information.

6 By the same token, many of 293 may become  
7 irrelevant and not need to be answered, depending on  
8 what the final design looks like.

9 COMMISSIONER DIAZ: I know that.

10 I was thinking at this moment have you  
11 found any witnesses.

12 All right.

13 Let's see, I guess we talk a lot about  
14 anticipatory research.

15 I'm fascinated by anything that decreases  
16 defusion out of a package, including saturation of  
17 component -- something that we used in many cases.

18 So in this case, you know, I think I would  
19 be interested if the Committee you would think a  
20 little bit ahead and maybe provide us with some, you  
21 know, suggested anticipatory research.

22 I know you talk about radionuclide  
23 transports, source terms, a few of those, but are there issues even if it's  
24 brainstorming I think it certainly would be  
25 interesting.

1 I know you have attended some of the  
2 meetings on the Yucca Mountain and we are always  
3 interested in how well we are doing with the public  
4 as far as are we communicating well.

5 Do you have any feedback to us and how  
6 those meetings have gone and can we do something  
7 better?

8 DR. HORNBERGER: Ray, you probably were.

9 Why don't you take that?

10 DR. WYMER: First off, I would say that our  
11 meeting is out there each and every year attended by  
12 the same people.

13 DR. HORNBERGER: I think Commissioner Diaz  
14 was talking about technical exchange between NRC and  
15 DOE.

16 MR. WYMER: Oh, I'm sorry.

17 I totally missed the point.

18 I was thinking about what I would ask.

19 The technical exchange meetings take place in two  
20 forums really.

21 There is a joint meeting where both the NRC  
22 staff and the Center staff, and the DOE people are  
23 there. And then the NRC staff splits off, goes off  
24 and caucuses about what they heard and they say here  
25 are additional things that we need to know, and

1 that's very frank, gloves off discussion.

2 I mean, it's just like it should be and  
3 then they go back into DOE and say here is a bunch of  
4 things that we have come up with.

5 And DOE comes back and say, well, we'll do  
6 that, and that and that, but we don't think that one  
7 is important, we have already done that one.

8 In their opinion, they have. So that's the  
9 nature of the meetings. And the one I attended was I  
10 thought very productive.

11 MR. GARRICK: I wanted to comment on that  
12 too, Ray.

13 I attended one and obviously the one on the  
14 performance assessment. And the reason I cut in here  
15 and wanted to say something, it is in fact one of the  
16 most impressive activities I have observed at the NRC  
17 since I have been on the committees and I didn't  
18 expect it to be that efficient and that well managed.

19 I think that -- I was always suspicious  
20 that a meeting in an environment such as we are  
21 required to hold these technical exchange meetings  
22 they didn't lend themselves to real intimate  
23 interaction among technical people on serious issues.

24 But I found the meetings given those  
25 conditions to be run extremely well and very

1 efficient. And I was especially impressed that -- of  
2 the staff members taking full advantage of today's  
3 technology because the reports were done on line in  
4 real time and it was possible to review questions and  
5 agreements just about as quickly as they came up.

6 I think it's a very efficient operation.

7 I found it superior to what we had in the  
8 earlier days and the reactor field in technical  
9 exchanges.

10 And I think that the staff has done a very  
11 commendable job of structuring a process here that is  
12 very effective, very efficient.

13 So that's one area I would really give  
14 praise to, and I don't know whether the technical  
15 exchange meeting I went to was representative of all  
16 of them. But I know the one I went to was very  
17 impressive.

18 COMMISSIONER DIAZ: That's very high praise  
19 for our staff and we thank you.

20 Let's go for fun.

21 Let's go to risk performance, performance based, risk  
22 informed performance based.

23 First let me start by saying that you have  
24 supplied me with some words that I will use quite  
25 frequently with the staff regarding how you do

1 research or how you analyze an issue and this  
2 evidence-based versus assumption based.

3       And I think that is fundamental and this is  
4 independent of whether this is going to be risk  
5 informed.

6       I have lately been surprised that people  
7 use assumptions as we all do to simplify but those  
8 assumptions get carried farther than what they are  
9 intended and they are not based on evidence.

10       So I appreciate the term and I appreciate  
11 the intellect behind it. I think it's very good.

12       Let me go from there to some of the concerns I have, and they are  
13 very basis on some of the areas that you touch on risk informed and performance  
14 based and I just want to make sure that we are using  
15 this term in the same manner, you know, we of course  
16 steer away from risk based and I have been trying to  
17 use a definition myself just to make sure and that  
18 is, you know, risk inform.

19       You know, it's a set of tools and resource  
20 that have elements of experience and deterministic  
21 and probabilistic and we get the best set of those  
22 and use them.

23       Are you using that in the same context when  
24 you talk about risk informing the process by which we  
25 are going to analyze the DOE Yucca Mountain?

1 MR. GARRICK: I think so.

2 You know, I have never seen -- I have never  
3 appreciated the debate of deterministic versus  
4 probabilistic assessments because I don't think that  
5 you can do a very good probabilistic analysis  
6 without first doing a very good deterministic  
7 analysis.

8 So I think we are on the same wave length  
9 as far as these terms are concerned. There is as you  
10 know a severe language problem in the whole risk  
11 arena.

12 And there is different risk communities  
13 that have their own sets -- their own language sets.  
14 The health sciences have their terms, physical  
15 sciences have their terms and others -- the financial  
16 world has theirs.

17 So this discipline has got a long ways to  
18 go to reach a level where a lot of those languages  
19 can be standardized.

20 COMMISSIONER DIAZ: Well, that's precisely  
21 my concern, is that we and the Commission, you know,  
22 defined years ago what we meant about it and what we --  
23 you know, how we intend to use the term and what does  
24 it means and how -- but I'm not sure that this  
25 carries all the way.

1           Are we trying to make that when we talk  
2 about risk informed, you are actually talking in the  
3 same --

4           MR. GARRICK: Yes, we are trying to avoid  
5 the concept of risk based as well and I think we are.  
6 As we get into the serious review of a license  
7 application, it's going to become clear.

8           COMMISSIONER DIAZ: But it is important  
9 that people realize that there is really not possible  
10 to do everything on a risk basis, that we need to get  
11 it, you know, induce evidence based versus just  
12 assumptions whenever we can to form a better,  
13 stronger case and what always attract me from  
14 evidence-based is that in a sense it diminishes the  
15 degrees of freedom because you are establishing from  
16 the beginning the base from which you can go forward  
17 and in many ways it of course decreases the  
18 complexity but in a matter that you can justify it,  
19 rather than based from assumption.

20           And this was the way you are using it and  
21 the way you are looking at it?

22           DR. HORNBERGER: I will say that the ACNW  
23 completely embraces the Commission white paper on  
24 risk that you refer to.

25           We are well aware of that.

1 It's a wonderful document.

2 MR. GARRICK: We thought that was a very  
3 major break through when the Commission went out on a  
4 limb so to speak and wrote down what they thought.

5 COMMISSIONER DIAZ: Good.

6 Then let me get to the next issues and it  
7 is, you know, you insist and rightly so, on quantification of  
8 uncertainties and of course I agreed, you know, if  
9 you have a result, you need to know what the  
10 uncertainty of the result is.

11 Quantification of the uncertainty is  
12 sometimes more difficult than quantification of the  
13 result itself and it takes you to the next higher  
14 intellectual level.

15 And I wonder whether you can clarify  
16 whether, you know, quantification of uncertainty  
17 carries on to what level of importance?

18 You know, I was concerned whether it effect  
19 a first significance, second significance or a third  
20 significance. And I think we need to be careful  
21 because sometimes when we say uncertainty, and it  
22 gets published. People see it as, you know, you  
23 don't know what the heck you are doing and actually  
24 quantification of uncertainty is when you really know  
25 what you are doing very well.

1           And so, could you give me some sense of how  
2 you dealing with quantification?

3           MR. GARRICK: Well, the uncertainty issue  
4 is the one issue that causes a great deal of anxiety  
5 among a lot of people because they see with it the  
6 need for huge quantities of information and data and  
7 they see it as a statistical concept and we don't  
8 think it has to be that. We think that the issue of  
9 uncertainty is something that's important.

10           But you need to be reasonable and rational  
11 about how you approach it and in particular, you  
12 shouldn't get yourself hung up on quantifying the  
13 uncertainty of a parameter that doesn't make any  
14 impact on the result that you are trying to achieve.

15           So in practice and from an analysis  
16 standpoint, the idea has been to do analyses that  
17 give you some insight relatively quickly as to what  
18 the most important contributors are and its most  
19 important issues are and then as you refine that, you  
20 do that perhaps in a point estimate basis.

21           Then you begin to turn up the microscope on  
22 what you have identified as important and that  
23 includes the quantifying of the uncertainties. And  
24 there is a great deal of miscommunication and  
25 confusion on this whole business of uncertainty

1 analysis.

2           And I have always thought that one thing we  
3 ought to know pretty well is what we don't know and  
4 that's part of the quantification process.

5           The problem there is that analysts don't  
6 like to, you know, admit that they don't know a  
7 parameter and perhaps very well and they don't like  
8 to represent the parameter on the basis of what is  
9 really known about it, which usually means, if it's  
10 now become a very important contributor to what we  
11 are trying to calculate, which usually means the  
12 erection of a property distribution about that parameter.

13           So I don't think it's a show stopper in  
14 terms of utilizing the concepts of quantifying  
15 uncertainty to support our analyses. I think it's  
16 more a matter of relying on first principles and  
17 getting some sense of what is important and screening  
18 out things that you know are not important and there  
19 is a lot of progress that's been made in that whole  
20 arena.

21           And then you find yourself generally in  
22 most cases with not so many things to worry about in  
23 terms of doing an uncertainty analysis.

24           But then you need to do the uncertainty  
25 analysis because it is the uncertainty that is the

1 risk.

2 COMMISSIONER DIAZ: How good are we doing  
3 in this respect?

4 MR. GARRICK: I think we are making  
5 progress.

6 I think that we have come a tremendous way  
7 in the last couple of years, so -- but it is -- but  
8 it is -- it hasn't stabilized yet as to what the  
9 approaches are.

10 But we are making lots of progress.

11 COMMISSIONER DIAZ: Still uncertain?

12 MR. GARRICK: Yes.

13 CHAIRMAN MESERVE: Commissioner  
14 McGaffigan.

15 COMMISSIONER McGAFFIGAN: Let me try to  
16 pick up in a different place.

17 Some of you had experience with WIPP  
18 certifications and it strikes me that I saw a lot of  
19 that process when I was working for Senator  
20 Bingerman. A lot of it was completed by late 1996.

21 I don't remember anything like the  
22 complexity that is involved in our process, I don't  
23 remember DOE -- I mean, EPA, excuse me, having a WIPP  
24 review plan that was encyclopedic in length.

25 I don't remember EPA producing a safety

1 evaluation report that will probably stretch from

2 Karen Cyr to me when the staff finishes it.

3 Why is our process so much more complex

4 when the standard is the same?

5 The standard is a reasonable expectation

6 that over a ten thousand year period, the reasonably

7 maximum exposed individual will not receive more than

8 15 millirems per year and there are a couple of

9 others, human intrusion, ground water, but it's the

10 same standard.

11 So why do we have to have -- you are just

12 talking about it, you know, discipline process that

13 focuses on the real things.

14 How do you figure out in the encyclopedias

15 where the real things are? And again striking from

16 my experience, EPA was working on the real issues the

17 entire time. And the little group that was in New

18 Mexico that was for the State of Mexico watching what

19 DOE was doing and focused on the real issues and I'm

20 not sure whether our process gets focused on the real

21 issues.

22 So what's different?

23 MR. GARRICK: Well, I'm not sure I can give

24 you the answers you're looking for, but I feel that I

25 have to because I was chairman of the National

1 Academy Committee on WIPP, and I lived through about  
2 ten years of that certification process.

3 And by the way, the certification documents  
4 that ended up being the basis for the repository  
5 being certified, did cover from there to there in  
6 terms of the documentation and it went through a  
7 tremendous amount of evolution as far as --

8 COMMISSIONER McGAFFIGAN: That was the  
9 input documents from DOE.

10 The input documents from DOE I think will  
11 fill this room.

12 MR. GARRICK: Let me get to your point.

13 I think that first off we are talking about  
14 an entirely different waste that we are trying to  
15 dispose of. It's very different in terms of what's  
16 driving the risk in the case of WIPP.

17 It was plutonium, it's basically the driver  
18 of the risk and it has a half life of the 10,000,  
19 20,000 years.

20 Whereas, here what's driving the risk is --  
21 are four isotopes of iodine, technetium, plutonium,  
22 which is common to both of them in the colloid form,  
23 and neptunium and make half lives of those four go  
24 from 10 to four years to 10 of the seventh years. So  
25 we are talking about an entirely different material.

1           COMMISSIONER McGAFFIGAN: Why are the half lives relevant when  
2 the performance standard is a 10,000 year performance standard?

3           We are supposed to make a judgment  
4 over 10,000 years whether recently maximum exposed  
5 individual is going to get more than 15 milirem.

6           I understand there's a peak dose that's going  
7 to be out there at a 100,000 to a  
8 million years, that higher, but for purposes of making a judgment  
9 about the repository, our standard, which is an EPA  
10 standard, is a 10,000-year standard.

11          So we have a few longer lived -- iodine 129 neptunium  
12 that are going to go out in a million years and a  
13 peak contributor in a million years, I guess.

14          MR. GARRICK: And the dilutions are much  
15 different.

16          The concentrations are very much different  
17 between the two.

18          The other thing of course is that the WHIP  
19 did not attempt to utilize the container as a first  
20 line of defense so much as in the case of Yucca  
21 Mountain and in the case of spent nuclear fuel and  
22 defense waste.

23          If their drums and the drums deteriorate  
24 pretty rapidly, and so it is a material that is  
25 exposed quite differently.

1           And then the other thing too is there are  
2 some people, including the National Academy, that  
3 believes that a salt repository is much more  
4 favorable than any other type.

5           COMMISSIONER McGAFFIGAN: If you don't want  
6 to retrieve it.

7           MR. GARRICK: Yeah, if you don't want to  
8 retrieve it.

9           But even there, a former member of our  
10 Committee who was a mining engineers said that  
11 retrieving is no problem. That's something that can  
12 be -- it's just a matter of cost.

13           So I do think there are a number of  
14 fundamental differences that make the two cases very  
15 different.

16           COMMISSIONER McGAFFIGAN: But isn't there a  
17 volume -- I mean, as I say, there may have been a  
18 large volume of material and I remember parts of it  
19 that went into the application, but EPA's analysis,  
20 they didn't have a center for nuclear waste.

21           They had a limbed number of staffers who  
22 over a very limited number of years - three or four  
23 -- it was ten, but in terms of the final product --  
24 it was three or four, breached their certification  
25 decision and their final reports were, you know, the

1 length of our Yucca Mountain review plan in terms of  
2 what was presented to us to Congress.

3       So have we made this -- are we introducing  
4 a lot of extraneous factors that, you know, in  
5 searching for perfection and total system performance  
6 estimates and whatever?

7       DR. GARRICK: Yeah, I want the other  
8 members to comment on this, too, but I think this  
9 does relate to an underlying issue, an undercurrent  
10 that this committee has been for a long time, that we  
11 really ought to be worrying about the low level and  
12 intermediate waste than we are, that the public is  
13 very focused on high level waste.

14       There is a -- the coverage of the high  
15 level waste issues have been far greater than the low  
16 level waste, the very descriptor itself tend to  
17 connote images that are not as much of a problem.

18       So part of the answer has to be that it is  
19 probably a bigger problem and a bigger issue than we  
20 are making it out to be, except that in the case of  
21 the true waste, the transatlantic waste and the  
22 repository approach to which disposal is very much  
23 different than the disposal process that have been  
24 generally employed for what we classify in this  
25 country as low level waste, where we put it in

1 trenches and vaults just a few feet under the  
2 surface.

3         And that's the one that a lot of the  
4 experts are saying that we are probably going to have  
5 to deal with in a more deliberate and systematic  
6 fashion down the road.

7         But I think that part of the answer to what  
8 you are saying is the perception that transuranic  
9 waste is a low level waste and that's just not the  
10 same kind of problem.

11         DR. HORNBERGER: Commissioner, I think that  
12 Milt also has -- let me interject my own answer.

13         I didn't serve for years on the WIPP  
14 Committee, but perhaps what you are driving at is  
15 that WIPP is a certification and Yucca Mountain will  
16 be a licensed facility and EPA does not have the  
17 licensing board --

18         COMMISSIONER McGAFFIGAN: That's part of it  
19 perhaps.

20         But EPA -- and that may be related to the  
21 degree they did not have to document every microscopic element of  
22 their decision.

23         MR. GARRICK: Commissioner, there is one very different  
24 thing that people might argue is why should WIPP be  
25 put through that when Yucca Mountain is not and that

1 is that WIPP has to be recertified every five years  
2 which is a very short time cycle and they have to go  
3 through some form of this exercise. And they are  
4 going through it right now about because three of the  
5 five years are up -- every five years.

6 Now, whether or not that will continue, I  
7 don't know.

8 But that's certainly a complexity.

9 MR. LEVENSON: Well, if you don't know it  
10 by now, you will find out that you have a committee  
11 that doesn't necessarily agree on everything.

12 I was on the WIPP committee with John for a  
13 few years and I'm on the currently on the current  
14 committee and including things like this  
15 recertification -- the recertification is quite a  
16 different thing and the only thing it requires is to  
17 assure that there is no new information that would  
18 void what you have done in the past. You don't have  
19 to make lots of new arguments.

20 I think a significant difference in what's  
21 being done arises from the regulations and the  
22 policies of the agencies involved.

23 I don't think there is orders of magnitude  
24 different between tons of plutonium separated from  
25 fission products and plutonium still with fission

1 products which could have solved - got a lot of  
2 different things.

3 But I think the bulk of the differences do  
4 not arise from technical resources at all, but from  
5 legal regulatory tradition and what have you.

6 COMMISSIONER McGAAFIGAN: Thank you.

7 Let me go on to another question and it may  
8 parallel something that Commissioner Dicus asked  
9 about.

10 You know, as I said earlier, our goal is to  
11 figure out at the end of this licensing process  
12 whether the reasonable maximum exposed individual  
13 over a 10,000-year period is going to receive 15 milirem or  
14 less and it strikes me some of your push for perfection  
15 in the performance assessment may or may not be  
16 relevant to that.

17 I mean, this group has a history, I mean,  
18 we had a letter from your on part 70 back in January,  
19 the staff did -- where you continued to push for  
20 using probabilistic risk assessments for the ISA.

21 And we made a policy decision as a Commission that  
22 we were not going to require PRAs for ISAs, that  
23 the tools short of a full blown PRA for a chemical facility, we are going to  
24 be adequate to our regulatory purpose. And I'm just  
25 wondering whether your being, you know, -- you are

1 seeking perfection standard where the standard is a  
2 reasonable expectation standard and you are also  
3 wanting to quantify risk.

4       It doesn't say - it's a reasonable  
5 expectation with an error band of X.

6       We didn't get into trying to quantify risk  
7 nor did EPA.

8       So aren't you pushing us into space -- it's  
9 well beyond anything that requires compliance with  
10 our rules.

11       DR. GARRICK: I think that's a good question  
12 and I also want to point out that the letter that you  
13 are referring to was a joint ACRS, ACNW letter.

14       COMMISSIONER McGAFFIGAN: We have got a  
15 bunch theoreticians in both groups of people in the  
16 group.

17       I wouldn't want to spend a sum of money --

18       MR. GARRICK: I don't that that's what's  
19 happening.

20       I don't think the PRA thought process has  
21 any intention of achieving level of precision that are  
22 unreasonable and I think one of the things that we  
23 haven't learned how to do is what I would call  
24 simpler PRA's, PRA's that don't involve the  
25 complexity, for example, of a nuclear power plant and

1 all of the activities that go on subsequent to a melt  
2 down and accident progression analysis and  
3 complexities that arise from trying to model  
4 something such as that.

5 Now, I have seen PRA's done on systems that  
6 can be done rather efficiently and with time probably  
7 as efficient in the integrated safety assessment  
8 process because the integrated safety assessment  
9 process involves many of the tasks associated with  
10 the PRA.

11 They do scenario analysis, they address the  
12 issue of frequency of occurrence and at the scenario  
13 level.

14 They just don't integrate --

15 COMMISSIONER McGAFFIGAN: They don't make a  
16 judgment. I don't want to go too much more here and  
17 leave it. But you guys say I don't have a total risk  
18 number then because I have --

19 MR. GARRICK: I think the concept of  
20 uncertainty analysis allows you to have a great deal  
21 of flexibility on your risk assessment.

22 COMMISSIONER McGAFFIGAN: But I think both  
23 you ACRS in that area and I'm afraid you might be  
24 doing in this area and pressing beyond the rules --  
25 beyond what is required by the rules by any

1 reasonable interpretation of the rules. And I worry  
2 about that and I worry about how costly it's likely  
3 to be.

4 In the case of ISA I think the staff answered you and I'm in  
5 agreement with the staff's answer.

6 Here, we have this tremendously complex  
7 process, we have a tremendously complex task before  
8 us in regulatory space, even if we tried not to make  
9 it complex, then I think at times we make it more  
10 complex.

11 But I used my fifteen minutes.

12 But I have other questions but I think I'll  
13 ask them another day.

14 MR. GARRICK: I would only end that with  
15 the comment that I think the whole idea of risk is  
16 not to make it more complex, but to make it simpler  
17 and I think we have a  
18 great deal to learn about the application of the  
19 risk assessment thought process on nonreactor  
20 facilities.

21 And we are beginning to see that and we  
22 keep putting the reactor template on other facilities  
23 and that's not the way to do it.

24 DR. HORNBERGER: And for the record, I  
25 would just like to say our intent is not to strive

1 for perfection as you said.

2 I really don't think that that's an issue

3 at all.

4 In fact, we are much in favor of fairly

5 simple models to address these questions.

6 I personally believe that our push in terms

7 of the Yucca Mountain really aims at making sure that

8 we -- that the NRC and the staff will get the

9 information that it needs to make a decision and it's

10 actually beyond my comprehension that this will be

11 doable unless we have a reasonable assessment of the

12 risk to the facility.

13 I just don't think it's going to be able to

14 be done with confidence without that.

15 So technically, maybe we are pushing a

16 little beyond the letter of the regulation, but I

17 don't think we are pushing beyond the spirit of the

18 regulation.

19 It's not our intent, certainly.

20 CHAIRMAN MESERVE: Commissioner Merrifield?

21 COMMISSIONER MERRIFIELD: Thank you,

22 Mr. Chairman.

23 Our Chairman is given an opportunity where

24 various Commissioners get to go first and that means

25 we are in rotation, which means in this particular

1 circumstance I am last.

2       It also means that most of the questions  
3 that I have wanted to ask have already been asked.

4       Now, Commissioner McGaffigan may have more.  
5 He wants to ask -- but given the time, I'm not going  
6 to give my time back to him.

7       For the sake of our audience both here and  
8 on video screen, I would adhere to that request.

9       I have got a couple of comments I want to  
10 make and there is one area I want to approach a  
11 little bit.

12       First comment is I do want to thank the  
13 ACNW for being generous in terms of its time and  
14 flexibility of its time as well as the nature of its  
15 presentation in order to accommodate what the  
16 Commission desires and perhaps earlier in the year  
17 you had some thought about a different presentation,  
18 but this one for me has been useful.

19       So I want to thank you for that.

20       The other thing I would want to  
21 acknowledge, you went through some pains today and I  
22 appreciate the comment earlier about trying to make  
23 sure we not get down into the use of too many  
24 acronyms.

25       I made that comment for a variety of

1 reasons.

2       One of which I think most importantly, now  
3 that we are videostreaming all of our meetings such  
4 as this and given the importance of what we discussed  
5 today, particularly, the individuals out in Nevada  
6 who may be viewing this on their computer screens, I  
7 think it's important for us to remember that audience  
8 in the presentation not merely the folks sitting here  
9 at the table.

10       So while there was some merriment to that,  
11 there was some seriousness to the purpose.

12       I guess my question is, and we -- Dr. Wymer  
13 went into the issue of research and anticipatory  
14 research and this is the one we have debated quite  
15 frequently here at this table and outside of this  
16 table over the course of the last few years and I  
17 have always been somewhat troubled by that particular  
18 term.

19       I think a different way of looking would be  
20 user directed versus nonuser directed research  
21 because I would hope that irrespective of whether it  
22 was NRR, NMSS, or Research that came up with the  
23 notion of a particular item needed to be researched and  
24 hopefully would have some degree of anticipation in  
25 it.

1           So I think anticipatory research is  
2 somewhat of an ill-fitting term.  
3           At the end of the day, it seems to me  
4 whether it is defined by the user, I.E., NRR, NMSS or  
5 a nonuser defined, I.E, through research, at the end  
6 of the day, it should be directed toward the  
7 Commission making decisions.

8           Is the research going to result in the  
9 Commission being able to make a regulatory decision?

10          And what troubles me a little bit and I  
11 know where you're coming from in your question.

12          You used a couple of examples.

13          Gee, here are some things if DOE does X, we  
14 should be thinking about Y.

15          And when we start getting into that territory,  
16 it's difficult to bound what all those possible  
17 things are, and I think it is very dangerous  
18 territory for the Commission to try to read the mind  
19 of the Department of Energy.

20          And so I would -- I'd like you to think  
21 about that a little bit in terms of -- and perhaps  
22 you may want to come back to the Commissioner at some  
23 later point.

24          I think it's useful as you review our  
25 research program to try to help us identify either

1 some areas where the Commission will have to make a  
2 decision down the line and for which we will need  
3 additional research versus things that are more  
4 curious in nature that may or may not get us there.

5 And so I don't know if you want to follow  
6 up on that one at all.

7 But we have -- the point I want to make, we  
8 have a limited amount of money.

9 The five of us have to make hard budget  
10 decisions and we have got to make budget decisions  
11 based on things that may potentially come in front of  
12 us and in simply answering permeation of various  
13 questions isn't going to help us make those hard  
14 budget decisions.

15 MR. WYMER: We didn't mean to take the  
16 position, I certainly didn't, that we want to decide  
17 or can decide what we call anticipatory research  
18 might be.

19 We think that's something that the staff is  
20 best qualified to do. They are closer to the  
21 problems and understand what the NRC's needs are,  
22 perhaps better than we do, they are there day after  
23 day, day in and day out. So they are closer to the  
24 details.

25 But nonetheless, there should be some

1 discretionary money to look forward to some of things  
2 that are not obvious needs but are probable needs.

3         And admittedly, it's a very tough decision  
4 in light of limited resources to make the decision,  
5 but there should be some ability to reach out to  
6 areas, several areas like this, just to cover yourself  
7 and be sure that you are not caught up short and you  
8 have to carefully examine where NRC is going, what's  
9 coming, what's on the horizon, what problems areas  
10 are likely to rise.

11         Some day the repository will drop below the  
12 horizon and there will be other things coming up.  
13 And at that time it would be desirable to have some  
14 system in place, some method in place to decide what  
15 problems are likely out there which are not  
16 certainties but which are probable or there is a  
17 reasonable expectation that there might be a problem  
18 there and just spend some modest resources in  
19 addressing those, especially in cases where if the  
20 problem does arise, at the time it arises for sure,  
21 there is not enough time left to get the information that  
22 you need.

23         It is a very tough line, a tough decision.

24         We understand that.

25         But there should be some allowance made for

1 a little of that.

2 I certainly understand what you're --

3 COMMISSIONER MERRIFIELD: I'm going to come  
4 back to you on that just because one doesn't want to  
5 have too much about words, but the notion of  
6 discretionary monies.

7 I'm going to jump on that one and you got  
8 to give me a second.

9 Congress does not want us to have  
10 discretionary monies. We are not going to have a  
11 kitty or a pool -- we are not going to have a kitty  
12 of money of research to do things they may think may  
13 be interesting to do.

14 If our Office of Research or any of our  
15 offices identify areas that they think we ought to  
16 look into because we need to make a regulatory  
17 decision and they come up with a good explanation why  
18 they should do it, then, yes, this Commission should  
19 fund those kind of things.

20 This Commission has done that when we have  
21 been provided with an articulate reason by the Office of  
22 Research why they should do that.

23 And this is something for future  
24 consideration, if there are items that our offices  
25 have missed for which you think the Commission would

1 have to make a regulatory decision or if our Office of Research  
2 or otherwise are not doing the research efforts necessary to help  
3 us make that decision, then I think it will be my  
4 expectation that you will provide us with specifics  
5 about what those are. And you don't need to respond  
6 to that.

7 MR. WYMER: And that is a judgment call, in  
8 some cases whether or not this area meets the  
9 criteria to make the expenditure funds in those  
10 areas.

11 COMMISSIONER MERRIFIELD: Well, that's the  
12 hard budget choice that we get to make.

13 But you get to make the recommendations.

14 MR. WYMER: Certainly any research like  
15 that that you suggest has to pass certain credibility  
16 tests.

17 There has to be something that there is a  
18 reasonable expectation that there will be needed.  
19 But it doesn't have to absolutely be proved that it  
20 would be needed. That is an anticipatory research.

21 MR. HORNBERGER: If I could give just a  
22 very quick, different spin.

23 As you probably know,  
24 Commissioner Merrifield, former Commissioner Ken  
25 Rogers when he was a Commissioner, articulated a

1 somewhat different position on research within the  
2 NRC.  
3 And his view, if -- well, I should be careful.  
4 My interpretation of his view -- I don't  
5 want to speak for Commissioner -- former Commissioner  
6 Rogers, was that he thought that the NRC to make  
7 informed decisions it was absolutely essential that  
8 they have research, credible research venture and to  
9 keep researchers happy, one has to allow them to do a  
10 certain amount of anticipatory research and I think  
11 that's another side of the argument that's perhaps  
12 more pragmatic than identifying individual research topics.

13 COMMISSIONER MERRIFIELD: I had the  
14 discussion with former Commissioner Rogers and I  
15 think there is a way of achieving both by having --  
16 and we did.

17 We need to keep the high quality, very high  
18 quality research people, keep them interested in  
19 doing useful things.

20 But we are not in a position -- my personal  
21 view and I can't speak for any of the former members  
22 of this Commissioner, it is not the expect of  
23 Congress since I been here that we are going to be  
24 funding research projects for the sake of funding  
25 research projects.

1           And my standpoint is, you know,  
2 Commissioner Rogers' background is working - is  
3 university research and so that colors his  
4 recommendations. And my background is having worked  
5 on Capitol Hill for 13 years and that colors my  
6 background.

7           So you can take either one.

8           CHAIRMAN MESERVE: I would like to thank you  
9 all for a very helpful briefing.

10          As always, we have had a spirited exchange.

11          That's the conclusion of the presentation.

12          We have gained a great deal from that and  
13 we hope it was helpful to you as well.

14          With that, we're adjourned.

15          Thank you.

16          (Concluded at 11:45 a.m.)

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