

1 In this area the problem has been  
2 accelerated in the last few years, and now we know  
3 that DOE has put in a lot of research, and this is  
4 reflected here in the technically updated biyearly  
5 report.

6 And one of the more solids in thermal  
7 sizing is to provide additional new information in  
8 Appendix Number E, and that is the waste package.  
9 That means that obviously we have to concern ourselves  
10 to be very clear to express the concern, and at some  
11 point at the time of the license that we not be  
12 completely clarified.

13 But the duration is right, and I think  
14 that we are in the condition of evaluating the  
15 progress. We need to monitor this very closely and  
16 help to rectify. If we see that the priorities are  
17 going to some issues that are not so relevant as  
18 others.

19 MEMBER GARRICK: Okay. Thank you. I have  
20 no further questions.

21 CHAIRMAN HORNBERGER: Gustavo, I just had  
22 one question. You had mentioned in your work plan for  
23 2002 that you were going to complete the assessment of  
24 natural archeological and industrial analogs.

25 Are there any requirements -- do any of

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1 your KTI agreements go to natural analogs, or is this  
2 something that you are doing because you think that it  
3 is important information to bring to bear on the  
4 analysis?

5 MR. CRAGNOLINO: Yes. There was not  
6 specific agreement in the CLST KTI, but this turned  
7 out to what is called multiple lying of evidence  
8 issue, and I think it is important.

9 It is clearly something that we overlooked  
10 at the time of the CLST agreement, because we were the  
11 first kids on the block really. We didn't pay  
12 attention, and also we have to recognize ourselves  
13 that the fact that the industrialist period was just  
14 very limited, and we did not give it the importance.

15 And that we realized that there was  
16 concern on their part, and there was concern on the  
17 nuclear waste technique review board and the title is  
18 a little bit out of the issues, because it is very  
19 difficult to cover completely this type of issue.

20 And the industrialist period in Alloy-22  
21 is 20 years, but we tried to combine as much as  
22 possible information for other industries, and also  
23 made the fundamental case of specific localized  
24 corrosion for natural or archeological analogs that  
25 can't have something relied. This is the only thing

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1 that we can say.

2 MR. AHN: This is Tae Ahn, and I would  
3 like to add one more thing. We did not specifically  
4 write any agreement.

5 CHAIRMAN HORNBERGER: Okay. You did. And  
6 as you pointed out, Gustavo, you were the new kids on  
7 the block. Have other kids followed you on to the  
8 block?

9 MR. CRAGNOLINO: We don't have too much  
10 integration to people. Well, the center has a  
11 tradition in this. You have to realize that many  
12 years ago there was precisely in the center that we  
13 were sharp to this kind of issue of natural analog for  
14 all of your geochemical type of aspects in particular,  
15 and in relation to source term.

16 And the center has the very good feeling  
17 of what you call in NOPAL 1, the face of --

18 CHAIRMAN HORNBERGER: No, I know all of  
19 that, but my question was a bit more specific, and  
20 that is do you know if DOE in particular is doing any  
21 work on analogs related to the current materials?

22 MR. CRAGNOLINO: As far as I am aware, no.  
23 In the case of metallic containers.

24 CHAIRMAN HORNBERGER: Right. Thank you.

25 MR. CRAGNOLINO: I'm sorry, for the source

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1 term, you know -- you are aware of that?

2 CHAIRMAN HORNBERGER: Yes. No, I am aware  
3 of all of that.

4 MR. HAMDAN: Gustavo, since you --

5 CHAIRMAN HORNBERGER: Use the microphone.

6 MR. HAMDAN: You seem to -- I mean, you  
7 seem to be allowing for the option of doing some of  
8 this work during the performance confirmation,  
9 correct?

10 MR. CRAGNOLINO: Well, no, no. Repeat the  
11 question again?

12 MR. HAMDAN: The question is that in the  
13 things that you think need to be done --

14 MR. CRAGNOLINO: Yes.

15 MR. HAMDAN: -- that some of this work can  
16 be postponed, or will be done during the performance  
17 confirmation.

18 MR. CRAGNOLINO: No. There is a different  
19 level. I see that the confirmation -- DOE is  
20 conducting a program in which they tried to measure  
21 corrosion rates in a series of embridlement that are  
22 in principle relevant for Yucca Mountain.

23 At the time of the license application,  
24 and I don't know when it is going to be, but let's  
25 assume that the license application is going to be 2

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1 years down the road, or 3 years down the road.

2 Then we have 3 years or 5 years down the  
3 road where they are already done for several  
4 environments, and they provide the time that they will  
5 be used for the license application.

6 But the series of embridlements and where  
7 they started the tests very early, or very late,  
8 modification that came from the other studies that  
9 maybe they have only 1 or 2 years, or just one year of  
10 testing.

11 So that means that 3 years will be 4  
12 years, and this is a very limited time. For this, we  
13 need to have a clear plan that they are going to  
14 continue this, because there could be surprises in  
15 this new type of new environment that they are  
16 testing.

17 MR. HAMDAN: But the question I want to  
18 ask is because of this option being available with the  
19 first confirmation, is it correct or incorrect to say  
20 that really the license application is an artificial  
21 midline, and it is because if there is something that  
22 they do not finish, or they do not have enough data  
23 for, they can always take it from the prelicense  
24 application column, and put it in the performance  
25 confirmation column?

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1 MR. CRAGNOLINO: But to put it in --

2 CHAIRMAN HORNBERGER: Let me interrupt and  
3 ask if Bill Reamer would like to give a short answer  
4 to that question.

5 MR. CRAGNOLINO: Sure. That is not my  
6 answer.

7 MR. REAMER: Thank you. Bill Reamer. I  
8 am not sure that it is quite that simple. I think  
9 that there probably are examples within specific KTIs  
10 -- perhaps this KTI -- of certain agreements that  
11 involve testing, and where data could come in after  
12 the license application under a performance  
13 confirmation label, or as part of the performance  
14 confirmation plan.

15 But to say that information that the staff  
16 needs for license application, if it is not available,  
17 could simply be moved to the performance confirmation  
18 column is probably not correct, because there is  
19 certain information that we need and we have provided  
20 that information to DOE. And we expect that it will  
21 be provided to us.

22 MR. HAMDAN: I just wanted to make one  
23 comment.

24 CHAIRMAN HORNBERGER: Okay. Really short.

25 MR. HAMDAN: Very short. This question

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1 was basically to the container because their life is  
2 10,000 years.

3 CHAIRMAN HORNBERGER: Right. Yes, but it  
4 is a more general question, and Bill, I think, had  
5 answered it, and we don't want to confuse the issue by  
6 saying that it is arbitrary, that license, and  
7 everything can be moved to performance confirmation.

8 CHAIRMAN HORNBERGER: Tae Ahn.

9 MR. AHN: Yes, I would like to add to  
10 Gustavo's answer to your question on whether the  
11 theories are working on the analogs. I believe they  
12 do to a certain extent, because they are implementing  
13 the agreement they had made with us.

14 I reviewed several presentations that  
15 analyzed the passive film to a certain extent.

16 CHAIRMAN HORNBERGER: Okay. Thank you.  
17 Any other questions or comments? Okay. Thank you,  
18 Gustavo. We are going to break for lunch, and we will  
19 start at one o'clock.

20 (Whereupon, at 12:15 p.m., a luncheon  
21 recess was taken.)  
22  
23  
24  
25

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A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

(1:06 p.m.)

CHAIRMAN HORNBERGER: All right. The meeting will come to order. This afternoon, again all afternoon, it is a continuation of our being updated on the key technical issues.

And we are just going to continue on. This is the presentation that was postponed from the original 11:20 presentation on unsaturated and saturated flow. So, go ahead.

MR. WINTERLE: Okay. I guess the mike is working. I am Jim Winterle from the Center, and the KTI is unsaturated and saturated flow under isothermal conditions.

The outline is pretty much the same as what all the other KTIs have been. I will try to add in a few extra remarks based on some of the questions that I have heard earlier today. But I will just go through that.

The KTI subissues are as follows. They are climate, and which was a category that the first two subissues fell under; present and future climate, and the hydrologic effects. That issue has been closed for some time based on the recent technical exchanges.

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1           Shallow infiltration is another one that  
2           is closed-pending. Deep Percolation, that is flow that  
3           moves below the root zone and the unsaturated zone,  
4           and that is also closed-pending based on agreements  
5           that I will talk about in a few minutes.

6           Saturated zone flow, and that is also  
7           closed-pending. And matrix diffusion is a cross  
8           between flow and a transport topic, but it has managed  
9           to find its way up through or under this KTI that is  
10          also closed-pending.

11          Let's see. What DOE needs to do. First  
12          of all, they need to decide on a repository design or  
13          set of design alternatives, and make sure that their  
14          model is consistent with that, and I bring this bullet  
15          up because of the low temperature operating modes that  
16          were illustrated in the SSPA, supplemental science and  
17          performance assessment reports.

18          And they showed some designs that diffused  
19          would necessitate changes to their unsaturated flow  
20          models. And that is the second bullet; that they  
21          would need to update the models to be consistent with  
22          the design alternatives.

23          And the third one, which is mostly what I  
24          am going to talk about, is that they need to provide  
25          the additional information related to what was agreed

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1 to in the recent technical exchanges.

2 And I will break those down in a general  
3 sense without going into each, but the shallow  
4 infiltration sub-issue has two open agreements, and  
5 both are due this year.

6 And if that information is acceptable,  
7 that should move to a closed status. The deep  
8 percolation subissue has six open agreements; one due  
9 this year, and five are due in '03 fiscal year. For  
10 the saturated zone, there are 12 open agreements, and  
11 two of them rely on USGS and Nye County data dealing  
12 with Death Valley regional models, and the Nye County  
13 drilling programs.

14 And so we are not too sure if DOE can  
15 commit to the date that we will receive that, but  
16 other than those two, the one is due in October, which  
17 is not yet received, and we will talk more about  
18 overdue agreements in a minute.

19 And nine are due this year, and the matrix  
20 diffusion, there is one that is not yet received, and  
21 two due this year. Let me back up to a previous one.

22 I will just generally go over the topics  
23 of the information that we are looking for. The  
24 shallow infiltration subissue; we are looking for them  
25 to document the Monte Carlo approach that they used to

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1 bound the uncertainty in infiltration.

2 The high and the low range, and the  
3 probabilities, and receiving certain distributions of  
4 infiltration, and the mountain surface was based on  
5 this, and it was not entirely clear to us how that  
6 process worked.

7 And then we also want them to justify the  
8 values of the parameters that were used in that  
9 analysis, and we expect that information this year  
10 again.

11 For deep percolation, there is an  
12 extensive ongoing field testing to justify the seepage  
13 estimates in the underground, and then we are also  
14 looking for some geochemical data to help substantiate  
15 their predictions of where flow will go below the  
16 repository.

17 For the saturated zone, we are looking for  
18 well data and analysis. Some of that from the C-  
19 wells, and the testing has been long since finished,  
20 but we have not seen all of the final results and  
21 analysis related to that.

22 And some of that is related to the Nye  
23 County wells, some of which are still being drilled.  
24 We have asked them to look at some alternative  
25 conceptual models for flow, and there is also an

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1 update to the regional flow model for the Death Valley  
2 ground water basin.

3 And we have not seen the update to that.  
4 That is a USGS report, and so we expected it last  
5 October, but it is just a little behind schedule. For  
6 matrix diffusion, we are looking for tracer test  
7 results, and we asked them to do some sensitivity  
8 analysis to help us gain some risk insight to how  
9 important that process is.

10 The overdue agreements I talked about, and  
11 three were due in October, and two of those three, the  
12 first and third ones, 501 and 604, had to do with the  
13 C-wells test, and we are still waiting for that final  
14 report.

15 And one had to do with the water level  
16 analysis with both the new wells that have just been  
17 drilled. In November, we were expecting some  
18 additional information regarding how the regional  
19 sites get models and interface, and are constructed.

20 I am not too worried at this point about  
21 any of these overdue agreements. All indications are  
22 that it is in the works, but it is something to keep  
23 an eye on if the backlog of overdue agreements gets  
24 big. We might want to bring that to a higher level.

25 A lot of the agreements are related to

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1 ongoing field studies and one of the questions before  
2 were if we were at all worried about information that  
3 might not be able to be completed before a license  
4 application could be submitted.

5 And I would say if there is anything that  
6 we are worried about, it would have to do with these  
7 ongoing tests in the unsaturated zone, and the tests  
8 dealing with the Nye County wells.

9 Presumably they should be able to finish  
10 this work by then, but as scientists, and as you  
11 yourselves all know, that the analysis of those tests  
12 can often take a long time.

13 The interpretation of those analyses can  
14 often be the subject of debate. We might be surprised  
15 by the results of the tests that we see, and offer  
16 alternative interpretations where the results of those  
17 tests might not be consistent with the current  
18 abstraction.

19 So those are potential areas where we  
20 might need to go back and request more additional  
21 information, or determine which fraction of the  
22 additional information we need or interpretations of  
23 those tests can be relegated to a performance  
24 confirmation period.

25 CHAIRMAN HORNBERGER: Jim, have they

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1 resolved the problems that they had with the ECRB  
2 passive tests?

3 MR. WINTERLE: That is a good example of  
4 communication between the NRC and DOE staff. They had  
5 found -- I think my next slide deals with that. Yes.  
6 In the close off, it was almost a two kilometer  
7 section of the east-west cross-drift, and to our  
8 surprise it seemed like there was a lot more water  
9 observed in there on a recent entry than was thought.

10 And to our further surprise, it seemed  
11 that tests were going to be terminated before there  
12 was a good handle on where that water came from and  
13 its source.

14 And I think Neil Coleman deserves a lot of  
15 the credit for this, and for getting with the  
16 Department of Energy people and insisting that we  
17 really need to understand where that water came from.

18 The early indications are that it is  
19 formed from condensate, but that raises the issue does  
20 condensate dripping need to be considered in the  
21 performance assessment extraction. Currently, it is  
22 not.

23 So where it has gone from there is the  
24 test plans for that ECRB were extended, and  
25 significantly enhanced, and cameras were installed,

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1 and sensors were installed, and air flow monitors were  
2 installed, and humidity monitors, and the period for  
3 the test now to my knowledge is specified as  
4 indefinite basically until they find the answers to  
5 the questions.

6 CHAIRMAN HORNBERGER: Can't they analyze  
7 the puddles and just figure out very quickly?

8 MR. WINTERLE: They have taken some  
9 preliminary samples and that is -- the early  
10 indications are that it is condensate. Of course, it  
11 lands on the conveyor belt and there is all kinds of  
12 crud on there.

13 So they have rigged up collections systems  
14 underneath rock bolts, and plastic sheets so that they  
15 can try to collect water in a more scientifically  
16 robust fashion.

17 MEMBER GARRICK: Was that the section that  
18 they thought they had closed off and in fact the  
19 ventilation duct went through the seal and was not  
20 sealed? Do you know?

21 MR. WINTERLE: I don't think so.

22 MR. LESLIE: Brett Leslie from the staff.  
23 I think you are talking about the heater test.

24 MR. WINTERLE: Yes, this one has a double-  
25 bolt cut head over a large portion of it, and so I am

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1 sure that there is some escape through the cracks  
2 around the bulk head, but they have done a good job to  
3 minimize that.

4 MR. COLEMAN: Excuse me, Jim, before you  
5 go on. Neil Coleman, NRC staff. One other item worth  
6 pointing out here that DOE needs to do before LA is  
7 resolving the chlorine 36 paradox, where there was one  
8 study that indicated no bump posts chlorine 36 at  
9 repository level, and all of the previous studies  
10 indicated numerous occurrences. We have an agreement  
11 related to that.

12 MR. WINTERLE: Thank you, Neil. What the  
13 NRC and CNWRA need to do before a license application  
14 would be to continue reviewing this DOE data  
15 collection associated analysis that they are going to  
16 use to validate the process in abstracted models, and  
17 review their modeling activities used to validate  
18 process in abstracted models.

19 And maintain familiarity with DOE methods  
20 and assumptions is a big part of what we do. There is  
21 a mountain of reports. And continue to develop the  
22 sites from our own process modeling, and I will  
23 mention some of that in a few minutes.

24 And interact with DOE as we have been  
25 doing over the past few years to make sure that they

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1 understand what our underlying concerns are. In 2001,  
2 some of our accomplishments were -- well, I guess I  
3 will start with the first bullet.

4 We identified and prioritized our tasks by  
5 those with the greatest technical and regulatory risk  
6 significance, which is what led to the KTI agreements,  
7 and we reviewed a mount of AMRs, and participated in  
8 the technical exchanges.

9 We have done our own independent  
10 unsaturated zone modeling and field studies. We have  
11 evaluated DOE's field studies that are ongoing. We  
12 have developed a saturated zone flow model that we can  
13 use in our own performance assessment, and to test  
14 alternative models for how geologic structure might  
15 affect flow.

16 And we are supporting the TPA code  
17 development and we have provided input for the Yucca  
18 Mountain review plan. In 2002, we have got a few  
19 milestone reports that we will provide to the NRC  
20 dealing with saturated zone modeling, and the  
21 hydrogeology of the Valley-Fill based on what we are  
22 seeing from the Nye County wells.

23 And that will be in integration with the  
24 structural deformation and seismicity KTI. A lot of  
25 that work. And we are going to do some of our own

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1 independent -- document some of our own independent  
2 modeling, and review DOE field studies in a report to  
3 NRC.

4 CHAIRMAN HORNBERGER: I am interested in  
5 that last bullet because you are talking about field  
6 studies, but you are going to do modeling and not any  
7 field studies of your own.

8 MR. WINTERLE: We are going to do --  
9 document some of our modeling of flow in the paint  
10 brush tough layer. There is -- this might be a good  
11 point to bring up changes that the Department of  
12 Energy made to their unsaturated zone model for the  
13 SSPA.

14 And we are not sure if that was just an  
15 aside from the TSPA SR, or if that is what they are  
16 planning to go forward with in the license  
17 application.

18 Those changes allow for significant  
19 lateral diversion of flow in the PT, and up to 40  
20 percent of infiltration can now be diverted away from  
21 a repository area.

22 We don't necessarily believe that there is  
23 data to support that and so we are probing with  
24 independent models of how that might work. We are  
25 also looking at effects of heterogeneity.

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1           And then in addition to that, we will have  
2 a separate chapter of the report that summarizes what  
3 we know so far based on the early information from the  
4 seepage studies.

5           And, of course, we are going to continue  
6 to review all the technical documents that come out of  
7 the Department of Energy. And this is more repeat,  
8 but we are going to continue our own independent  
9 modeling which improves our understanding of risk  
10 significance and preparedness.

11           I think it makes us better reviewers when  
12 we occasionally attempt to model some of these things  
13 ourselves. Review results of ongoing in situ niche  
14 and alcove studies and this provides feedback into the  
15 milestone reports that we will provide.

16           And on to the summary, where we have  
17 obtained agreements with DOE that we need to close or  
18 closed-pending status for all of our subissues. There  
19 is a review and is now incorporated into seven risk-  
20 informed integrated subissues.

21           I don't know how familiar the committee  
22 members are with the integrated subissues, but there  
23 are seven of those that this specific KIA provides  
24 input to.

25           I guess that relates to Bret's table here.

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1 The independent modeling and technical investigations  
2 that we do continue to provide us insights for the  
3 review of DOE models, and technical basis for our own  
4 TPA development.

5 And our review of the DOE field studies is  
6 vital for closure of these KTI subissues. There is  
7 also a table in the back that summarizes how all of  
8 this boils down into the sufficiency review.

9 CHAIRMAN HORNBERGER: So in Bret's table,  
10 Subissues 3 and 6, you had classified as minor, the  
11 level of complexity of the agreements, and 4 and 5  
12 were moderate to major.

13 So I guess it is pretty clear that you  
14 don't anticipate that DOE has any truly monumental  
15 hurdles to get over here?

16 MR. WINTERLE: Well, Subissue 3, that was  
17 closed before and they made some changes to their  
18 infiltration estimates. So we reopened that one. So  
19 we are expecting since the changes weren't drastic  
20 that that is a minor level.

21 The matrix diffusion one, that is Subissue  
22 6. I was actually surprised recently to find out how  
23 important that seems to be to their transport  
24 calculations in the unsaturated zone.

25 Yet it doesn't seem important for the

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1 saturated zone, and one of our agreements is for them  
2 to clarify why that is, and to make sure that all of  
3 the numbers are plugged in there correctly, because it  
4 doesn't seem to make sense.

5 But I think if they can answer that  
6 question, then it is minor in terms of the level of  
7 effort that it is going to take to close it. It is  
8 not necessarily in terms of importance.

9 MR. LESLIE: Bret Leslie from the staff.  
10 Just to remind you that this was a snapshot done  
11 approximately back in September. So that is as much  
12 as the information is worth.

13 CHAIRMAN HORNBERGER: As I said, we will  
14 get a presentation quantitatively what moderate to  
15 major means. Milt, do you have any questions?  
16 Raymond?

17 VICE CHAIRMAN WYMER: Only kind of an  
18 observation. We keep -- these keep being added into  
19 the models, and not only by you, but by everybody  
20 else. And then there is the question of updating all  
21 these models and running new tests.

22 It seems to me what is happening here, and  
23 what could be happening, is that you are generating  
24 mountainous piles of information that need to be gone  
25 through and examined for differences to find anything

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1 that is significant that changed.

2 What kind of or how practical is this, and can it be  
3 done?

4 MR. WINTERLE: Well, that is a good point.  
5 I am still finding things in the SSPA document that I  
6 didn't catch before. One example is the range of  
7 uncertainty for saturated flow, and it is from a  
8 factor of 10 to now a factor of 3. We are still  
9 considering whether that needs to be brought up as a  
10 problem.

11 VICE CHAIRMAN WYMER: That is you and  
12 everybody else, you know.

13 MR. WINTERLE: It is a difficult  
14 situation, and we can achieve closure with one certain  
15 model, but does that mean DOE shouldn't try to improve  
16 if they can their model? So I guess at some point  
17 they are going to need to stop and say this is what we  
18 are going forward with the license application with.

19 VICE CHAIRMAN WYMER: There is not much  
20 evidence of that so far.

21 MR. WINTERLE: I agree, that is really  
22 something that we are trying to stay on top of.

23 CHAIRMAN HORNBERGER: John.

24 MEMBER GARRICK: Can you just make a  
25 couple of comments about the scope and schedule of the

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1 DOE field studies?

2 MR. WINTERLE: The scope and schedule?

3 MEMBER GARRICK: Well, I will give the  
4 disclaimer that everybody gave, that that is up to  
5 DOE. But I think it is an ambitious undertaking.

6 MR. WINTERLE: But it is part of the  
7 agreements isn't it?

8 MEMBER GARRICK: It is part of the  
9 agreement.

10 MR. WINTERLE: The PTI agreements.

11 MEMBER GARRICK: I think the testing  
12 schedule that they have done, the tests certainly can  
13 be completed by the last I heard was 2004 for the  
14 license application. Don't anybody quote me on that.  
15 But I think that is reasonable.

16 CHAIRMAN HORNBERGER: This is being piped  
17 directly to --

18 (Laughter.)

19 MR. WINTERLE: But I think the testing can  
20 be finished, and the Nye County wells can be drilled.  
21 It is just a matter of whether the information and  
22 analyses that come out of that become controversial,  
23 or counter the current model abstractions. You just  
24 don't know what you are going to get.

25 Early indications with -- there is one

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1 test called Alcove 8-Niche 3, and they have an Alcove  
2 one 10 meters above the other, and I guess things in  
3 the field never go as smoothly as you would hope.

4 And they hoped that the water was going to  
5 go straight down on the fault pass and it looks like  
6 some of it is coming out into the access drift, and  
7 you can see it on the walls.

8 That wasn't really in the plan, but that  
9 does not necessarily mean that you can't get useful  
10 information from the test.

11 MEMBER GARRICK: Thank you.

12 CHAIRMAN HORNBERGER: Anything else?  
13 Staff. Okay. Thank you, Jim. And I guess we will go  
14 from isothermal to thermal.

15 MEMBER LEVENSON: Things are heating up.

16 CHAIRMAN HORNBERGER:

17 (Brief Pause.)

18 CHAIRMAN HORNBERGER: Randy, if you can  
19 introduce yourself for the record, please.

20 MR. FEDORS: For the record, I am Randy  
21 Fedors. I just recently took over the TEF part for  
22 the Center. I have listed the contributors, and most  
23 of them from last year contributed various portions of  
24 this.

25 And Jeff Pohle and Asas Chowdhury, too,

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1 are the managers on either end. It is the same  
2 outline that you have seen all along. The status and  
3 what DOE needs to do, and what we need to do, and what  
4 we have done in the past year, and this coming year.

5 This was unintended on how fancy that came  
6 out, and I didn't know what I was doing. It was a  
7 template from somebody else. Subissues. There are  
8 two subissues for TEF.

9 One of them is related to the features,  
10 events, and processes, and that just says the two  
11 technical agreements on the reports in the database  
12 are closed-pending.

13 The other subissue deals with all the  
14 topics for thermal effects, and can people hear me in  
15 the back by the way? Okay. I will assume everybody  
16 can.

17 CHAIRMAN HORNBERGER: Nobody responded and  
18 so that can mean yes or no.

19 (Laughter.)

20 MR. FEDORS: Okay. A thumbnail sketch of  
21 the different technical agreements for the TEF and  
22 determining temperature, humidity, saturation, and  
23 flux, and in numerical order here, and in no order of  
24 priority for us.

25 The first one is losses through the drift

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1 scale thermal test bulkhead. There was a question  
2 that started to allude to that topic, and the notion  
3 that they put heaters into a drift to mimic canisters,  
4 and then realized after they had been going for a  
5 while that there was quite a bit of heat loss out, and  
6 quite a bit of water loss out.

7 And on the order of two-thirds of the  
8 vaporized water is what they are predicting right now  
9 is exited through the bulkheads. So there is a  
10 technical agreement to come to some resolution of  
11 that.

12 The next one, the cold trap effect, is  
13 what I am lumping together, and the process where you  
14 have well known unsaturated zones, and ambient  
15 conditions or otherwise, that you should expect near  
16 99.9 percent relative humidity in the core space.

17 When you get that in a drift, as thermal  
18 pulses, you are not going to get -- as you are not  
19 drying out the zone, and you will start wrapping up  
20 that relative humidity to that near a hundred percent.

21 And you might start redistributing the  
22 vapor in the drift, and temperature readings are one  
23 reason that you would look for that. So if there is  
24 an edge effect in the repository, you might be driving  
25 moisture to the cooler zone, and condensing there.

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1                   So there would be an evaporation  
2                   someplace, and then the question is how much movement  
3                   of that vapor to another location were you then  
4                   condensing.

5                   By the way the passive test in the last  
6                   presentation was what really brought that back to the  
7                   forefront, and now the Department of Energy is dealing  
8                   with. The next topic is the ventilation model, and  
9                   two agreements. One was the ventilation test plan and  
10                  the other one was document the ventilation model.

11                  Since I might not discuss that later, I  
12                  will just quickly summarize it; that the DOE model was  
13                  a linked model. Here is our ventilation and here is  
14                  our thermal hydrology, and we will just apply a flat  
15                  rate heat loss reduction to mimic ventilation.

16                  The Center turned around and linked it  
17                  directly with multi-flow and a ventilation model that  
18                  entwined, and came up with a DOE approach that seemed  
19                  to be reasonable.

20                  So I may not mention that again the rest  
21                  of this presentation. The next three, parameter  
22                  uncertainty, and full uncertainty, and model  
23                  uncertainty, there are four or five agreements that  
24                  deal with this, and essentially we are looking for  
25                  -- there is a lot that we are not sure of.

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1           There is a lot of parameter uncertainty  
2           and model uncertainty. We want to take a stab at  
3           incorporating a full ensemble of model and parameter  
4           uncertainty in the TSPA, or come up with a  
5           justification for why it is not there. That is the  
6           gist of those agreements.

7           MEMBER GARRICK: Did you specify in any  
8           way how any of these things should be done? I am  
9           thinking of something like model uncertainty, which  
10          there is lots of discussion, debate, and controversy.

11          MR. FEDORS: Well, in a later slide where  
12          I tell you what we are trying to do in Fiscal year  
13          2002, I would have said that we are going to try and  
14          take a stab at ourselves first, and see where it is  
15          going to go so that we have some background if DOE  
16          comes up and says something, and that we will have a  
17          little bit more understanding of what is going on.

18          It is something that you don't look in the  
19          published literature for here is how to do it.

20          MEMBER GARRICK: That's why I asked the  
21          question.

22          MR. FEDORS: One way to do it, I think, is  
23          pure brute force and spend lots of manhours, but I  
24          don't think that is practical.

25          MEMBER GARRICK: I was just curious if you

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1 had developed some interesting and ingenious approach  
2 to that problem. Proceed.

3 MR. FEDORS: I am not that quick. The  
4 progress on the technical agreements, I put down that  
5 there are three that are considered satisfactorily  
6 addressed.

7 I think you can fluctuate that number  
8 between 2 and 4 depending on who you talk to and what  
9 the programmatic decision on what satisfies an  
10 agreement.

11 For the ones that we are going to be a  
12 little more concerned with, one technical agreement  
13 required a path forward, and that was the one that  
14 treat model and parameter uncertainly literally  
15 written into the technical agreement, stated that this  
16 will be discussed at the TSPA technical exchange.

17 Well, we needed a path forward, because  
18 that is not a path forward, and that's -- well, Jeff  
19 Ponle was telling me today that the NRC letter pending  
20 is not -- well, it is going through concurrence right  
21 now on how -- you know, what the path forward will be  
22 for that technical agreement.

23 We did not specify where it is going to be  
24 documented, but here is the essence of what we were  
25 looking for. There is one technical agreement waiting

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1 for a DOE response, and that has to do with the drift  
2 scale heater test. There was a white paper on that  
3 prepared by the Department of Energy.

4 And NRC responded, and then part of the  
5 technical agreement said that the Department of Energy  
6 will address NRC's comments. Seven technical  
7 agreements had some documents due in Fiscal Year 2002.  
8 So those are coming up.

9 Three agreements had delayed documents and  
10 the Department of Energy sent letters in July and  
11 October stating here is when we think these things  
12 will happen.

13 And also my last bullet notes that the  
14 approach that the thermal effects group has taken in  
15 the past year was that as things were delivered that  
16 letters were sent to the NRC either reviewing it or  
17 acknowledging that things were completed.

18 What does DOE need to provide before  
19 license application? With the flexible design and  
20 operating mode, one of the first thoughts that would  
21 come to my mind is, well, if they go with the low  
22 temperature operating mode, I don't think we have  
23 enough information for that.

24 It is a case where it is not only where  
25 they are expanding the repository domain and there is

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1 a characterization issue, but there is also maybe the  
2 cold trap effect that is going to become even more  
3 important for that operating mode.

4 And that is the second bullet and there is  
5 some data to support the cold trap effect. That is  
6 not to say that the cold trap is not going to occur  
7 during the high temperature mode, but for example, the  
8 low temperature mode, if there is no ventilation, you  
9 will be near a hundred percent relative humidity the  
10 entire duration.

11 With the high temperature mode, you get to  
12 60 percent relative humidity after 2 to 3,000 years  
13 approximately, and the canisters don't to below a  
14 hundred degrees C until 3 or 4,000 years, or something  
15 like that.

16 Anyway, there is a much shorter duration  
17 when the cold trap effect will be important for moving  
18 fluids around along the drift axis, for example.

19 The other thing that we are looking for  
20 before LA is some approach for the model and parameter  
21 uncertainty, and as was already noted, that is not  
22 clear how that is going to be done yet, and I think  
23 how one would do that.

24 I think it will end up being a combination  
25 of here is what is reasonable to do, and we will

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1 justify what we don't include, and we will expand  
2 uncertainty and account for things, and I will leave  
3 that one alone.

4 And then the last bullet is just a catch-  
5 all for the rest of the technical agreements. The  
6 first bullet where I just wanted to reemphasize that  
7 there is going to be water in these drifts at some  
8 time or other, and how it redistributes during the  
9 10,000 year period is what we really want to look at.

10 The passive test brought to the forefront  
11 really the cold trap effect, and that is an example,  
12 and we are concerned about that one. The data that  
13 has to be collected by license application, the  
14 importance of the Cross Drift Thermal Test is becoming  
15 more prominent here, but it is a test that is not  
16 projected to be started until 2003, and I have heard  
17 2004.

18 It is down the line for some reason, and  
19 I say that in terms of in light of the drift scale  
20 test problems, we are not sure what conclusions that  
21 we would be able to support coming from the drift  
22 scale test given all the water loss out of that test.

23 And some of those observations I would be  
24 referring to are when water starts -- the possibility  
25 of water going down fractures and through the dry out

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1 zone, the fingering, the reflux approach.

2 CHAIRMAN HORNBERGER: Do your agreements  
3 require our call for results from the cross drift  
4 thermal test prior to an LA?

5 MR. FEDORS: No.

6 CHAIRMAN HORNBERGER: Okay.

7 MR. FEDORS: And my feeling on that was  
8 that it was a combination that was practical and there  
9 is some information that you can get out of the drift  
10 scale heater test still.

11 But I think our position on that, if I can  
12 speak for others, is that there may be difficulties in  
13 quantifying that loss out there and what effect it  
14 has, and you had better include it in the model and  
15 parameter uncertainty.

16 The field and laboratory data to support  
17 the cold trap model. That one we don't even know what  
18 the DOE cold trap model is going to be, and that is  
19 not documented and presented to us yet.

20 I know that people are working on it, and  
21 that is about it. And the characterization and  
22 heterogeneity of properties in the lower lithophysal  
23 zone, that is the whole reason that they created the  
24 enhanced characterization repository drift block or  
25 block drift, was to get at the lower lith (sic).

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1           That is proceeding along I think and it is  
2 not going to be an issue. Another bullet, coming  
3 forward with the mismatch. This is kind of playing up  
4 to what I alluded to before.

5           Depending on the operating mode, other  
6 certain processes are going to become more important.  
7 So we may be caught in a bind at the end and we may  
8 not have this prior knowledge that the bind is going  
9 to be there.

10          And the last bullet on the model is  
11 parameter uncertainty, and we talked about that a  
12 little bit, but I might also add the point that this  
13 is a difficult one to handle because of the  
14 transparency issue with the multi-scale thermal  
15 hydrologic model.

16          There is an assemblage of 4, or 5, or 6  
17 numerical models linked by abstractions, and scan  
18 lines as they call it now. I think that may be going  
19 under some revision, but in essence how do you trace  
20 at least your parameter uncertainty through that whole  
21 chain? It is not straightforward.

22          What does the NRC need to do before LA?  
23 Well, you have probably seen a few of these same  
24 things here. I might just summarize them as a little  
25 bit of our job is to kind of anticipate what we are

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1 going to run into down the line, and that the meetings  
2 that we have with the Department of Energy certainly  
3 facilitate us being a little bit more up to speed on  
4 things, rather than waiting for a document to come out  
5 sometime later.

6 Fiscal Year 2001 work. The major  
7 activities, and all the technical exchanges are on the  
8 top of that list for a reason, I guess, time wise.

9 The ventilation modeling I alluded to  
10 earlier. The Mountain-scale thermohydrological  
11 modeling studies, and the main focus of those were  
12 primer sensitivity, and edge effects, and how that  
13 might dovetail with the cold trap effect.

14 I have the cold trap listed here and the  
15 technical support for the TPA code. In other words,  
16 providing temperature and relative humidity histories  
17 for the duration of the 10,000 year compliance period.

18 And I have one example to present, and  
19 that's the cross-drift thermal test. Some modeling  
20 was done prior, and obviously prior modeling, and  
21 predictive modeling.

22 The importance of this was that this niche  
23 test is in the lower lithophysal, and the other  
24 important factor is the problems with the drift scale  
25 test.

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1           So the main objectives are put in thermal  
2 heaters and see if we can predict the shedding of the  
3 water, and how water is going to flow through the  
4 fractures, and then analyze that water.

5           The modeling that I am showing here, this  
6 is a saturation, a three-dimensional model. The blue  
7 you can tell is where the dry out zones are, and that  
8 is the low saturation.

9           And the higher saturations are the yellows  
10 and oranges, and you can see some of the shedding  
11 going on there. The bore hold locations where there  
12 would be some collection, you can kind of pick that up  
13 here.

14           There is some little blue spots there.  
15 And in the modeling, they turned out to have a low  
16 saturation because it is difficult to get water into  
17 those. One of the conclusions of this study was that  
18 looking at the flux of the water that got in there, it  
19 was that it was condensed water.

20           It was water that evaporated and it was  
21 transported into there, and then condensed in the bore  
22 hole. That would have a major implication for how you  
23 are interpreting the chemistry of this test and the  
24 drift scale thermal test.

25           Work plan for Fiscal Year 2002. I will

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1 jump quickly since we are almost up to the 15 minutes  
2 here. The intermediate milestone reports are the  
3 focus of what we are doing, and that is, one, review  
4 all the technical agreement documents that we have  
5 gotten, and that will be organized around dealing with  
6 the model parameter uncertainty for the most part, and  
7 the cold trap effect, and dealing with the drift scale  
8 thermal test results.

9 I will also plug the cold trap modeling  
10 and that we have created a little laboratory  
11 experiment to try to understand a little more fully  
12 with an analytical solution to start up and design the  
13 experiment.

14 We have gone through some initial testing  
15 just to see and make sure that water is condensing,  
16 and that all of our sensors are reading stuff. I am  
17 not aware that the Department of Energy has a  
18 laboratory or a field test in the plans at all to  
19 support any of a cold trap model.

20 And to summarize, there are three  
21 technical agreements essentially completed, and seven  
22 more should be done this year. And the three have  
23 been delayed, and with that, I will take any  
24 questions.

25 CHAIRMAN HORNBERGER: John.

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1 MEMBER GARRICK: I don't think I have any  
2 questions.

3 CHAIRMAN HORNBERGER: Okay. Raymond.

4 VICE CHAIRMAN WYMER: Well, this question  
5 is going to tell you very clearly that I don't know  
6 anything about these kinds of processes. But what is  
7 more important with respect to humidity in the  
8 repository; the water that is brought in by the  
9 ventilation or water that drips in from percolation?

10 MR. FEDORS: It would be the other way  
11 around for the ventilation. The ventilation -- I  
12 think it was initially brought in to remove the heat  
13 load, but it is very effective at keeping the humidity  
14 way down low.

15 So as you soon as you shut off the  
16 ventilation -- for example, like during the low  
17 temperature operating mode -- the relative humidity  
18 shoots up immediately to a hundred percent.

19 VICE CHAIRMAN WYMER: And this gets  
20 outside of your scope, but the plan is that as each  
21 drift gets filled, they will close it?

22 MR. FEDORS: That is something that I have  
23 not sorted out entirely, and I thought there was some  
24 confusion because some discussion of ventilation,  
25 natural ventilation, so they would leave the drifts

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1 open to take advantage of any -- you know, they have  
2 got the infrastructure down there and there might be  
3 additional ventilation over and above an ambient  
4 ventilation through the mountain that would help them  
5 out.

6 But as I understand from the igneous group  
7 that they have -- that we need bulkheads in here to  
8 help out. So there is a conflict there.

9 VICE CHAIRMAN WYMER: Okay. Thanks.  
10 That's all that I have.

11 CHAIRMAN HORNBERGER: Milt.

12 MEMBER LEVENSON: Yes, I'm not sure that  
13 you used those very clearly defined words like  
14 important and less important, and more important, and  
15 likely.

16 But since water is the 800 pound gorilla  
17 in this entire thing, and there appears to be water in  
18 the drifts, and there isn't any corrosion, et cetera,  
19 how would you categorize the importance to the overall  
20 program of this particular KTI group?

21 MR. FEDORS: Well, if you want me to rate  
22 it, I would say it is 799 pounds. Do you want it more  
23 likely or less likely?

24 MEMBER LEVENSON: No, no, I think you  
25 would agree that it is one of the most important ones

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1       probably.

2               MR. FEDORS: It is an important issue, and  
3 I think the focus should be on the duration of time  
4 over which it is going to be left in there.

5               MEMBER LEVENSON: Are you comfortable with  
6 the modeling of thermal effects on flow vis-a-vis  
7 what's going on in the rock? In other words, do you  
8 think that we have a good enough grasp of the  
9 phenomena so that the questions of hot versus cold  
10 repository, et cetera, can be accurately modeled?

11              MR. FEDORS: I think the thermal part --  
12 if I had to categorize things, the isothermal part is  
13 very complex, and if you give me that part of it, I'd  
14 be a lot more confident in getting the thermal part  
15 correct. Is that kind of answering your question? I  
16 believe it's very complex how water flows through  
17 fractures.

18              MEMBER LEVENSON: Yes, but it's much more  
19 complex than just how water flows through fractures in  
20 that if you have a hot repository for a few hundred  
21 years, you're going to be having evaporation in the  
22 pores. If you have a cold repository, presumably you  
23 have almost none. Are those effects part of what  
24 you're looking at when you talk about thermal effects  
25 on flow? If you're evaporating water for 500 years,

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1 is there any porosity left when it finally cools down,  
2 et cetera? It seems to me there are some major  
3 issues.

4 MR. FEDORS: Then my point would be how  
5 quickly does it re-wet. We know that it will -- water  
6 will be supplied to the drifts through the fractures  
7 rather quickly to pass the test, things like that, but  
8 filling the matrix --

9 MEMBER LEVENSON: Yes, but filling your  
10 tea kettle up with water -- filling your tea kettle up  
11 with water doesn't redissolve the deposited stuff.

12 MR. FEDORS: Doesn't redissolve the  
13 depositing stuff.

14 MEMBER LEVENSON: Yes. For 500 years, if  
15 you're boiling or evaporating water out of these  
16 pores, at the end of that time, those pores are not  
17 automatically going to just open up.

18 MR. LESLIE: Milt, this is Bret Leslie  
19 from the NRC staff. This is really a question for the  
20 near-field where we take into account and evaluate  
21 those things.

22 MEMBER LEVENSON: Okay. I withdraw it.  
23 I was trying to find out where it's being covered.

24 MR. LESLIE: It's covered.

25 MEMBER LEVENSON: Okay.

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1 MR. FEDORS: Thermalhydrologic chemical  
2 near-field. So your question had to do with you've  
3 plugged up the pores of the matrix.

4 MEMBER LEVENSON: Just the whole -- all of  
5 the things that are different between the hot and cold  
6 repositories. There are many things.

7 CHAIRMAN HORNBERGER: On one of your  
8 slides where you listed -- the title was "Concerns."  
9 And the bottom bullet talking about incorporation of  
10 ensemble model and parameter uncertainty in TSPA and  
11 it says something about the path forward is the  
12 subject of a pending NRC letter to DOE. Can you tell  
13 me a little bit about that letter?

14 MR. FEDORS: Yes. Actually, I noted that  
15 in two slides. In the other slide, I mentioned that  
16 Jeff Pohle had mentioned today that that's going  
17 through concurrence right now. The letter basically  
18 said, "We realize that there's no path forward for  
19 this agreement. Here's what NRC was trying to get at  
20 with this techno agreement -- incorporate model  
21 parameter uncertainty or justify not including it in  
22 the TSPA. Please put this in some document, either  
23 one of those."

24 MR. POHLE: Yes. This is Jeff Pohle, NRC  
25 staff. It's basically a paragraph within the letter

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1 that covers a number of KTIs coming out to Jim  
2 Anderson. Basically, what we do in that paragraph is  
3 tie it into a number of items the Department said they  
4 were going to do. At the technical exchange, we got  
5 this thick handout, so we called out of there, "This  
6 is what you said you're going to do, and we think if  
7 you're doing this way to this agreement, that  
8 agreement, that agreement, this ensemble, if you did  
9 this, would be the path forward to resolve this  
10 particular item." I don't know the numbers well right  
11 now.

12 MR. FEDORS: I probably would say it's not  
13 a worry either. There was some discussion whether we  
14 even had to come up with a path forward, because these  
15 other technical agreements separately address  
16 different aspects of it.

17 CHAIRMAN HORNBERGER: Okay. But it's --

18 MR. FEDORS: So we just want to be clear  
19 on it is all.

20 CHAIRMAN HORNBERGER: So it's basically  
21 just clarifying the path forward.

22 MR. FEDORS: Yes.

23 CHAIRMAN HORNBERGER: Okay.

24 MEMBER LEVENSON: George, I have a  
25 question.

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1 CHAIRMAN HORNBERGER: Sure.

2 MEMBER LEVENSON: On your backup slide,  
3 Number 14, you give the technical support for the TPA  
4 code. Starting at time zero and going out for close  
5 to 100 years, the high temperature mode has the waste  
6 package temperature below 100 degrees, and that seems  
7 awfully low since the reason for going to the low  
8 temperature was to keep the rock temperature below 100  
9 degrees. And the waste package has got to be hotter  
10 than the rocks since it's the source of the heat, so  
11 it just seems that for a high temperature to be below  
12 100 degrees seems awfully low.

13 MR. FEDORS: Okay. These results contain  
14 a ventilation module, and you'll see the first spike  
15 straight up as, what, 50 years about? So this assumes  
16 forced ventilation for 50 years, and that's why I was  
17 alluding to it's very effective at removing heat and  
18 moisture. And in this particular modeling approach,  
19 they also played around with natural, quote, "natural"  
20 -- you know, what if natural ventilation kept going  
21 after the 50 years? So we'll ramp the ventilation  
22 down in the model to some fraction of the forced  
23 ventilation, and they did it in two steps. That's  
24 where these other spikes are coming from, just to  
25 explain the graph.

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1                   MEMBER LEVENSON: One other question: Do  
2     you know when they talk about natural ventilation, are  
3     they talking only about the chimney effect or are they  
4     taking into account the breathing of the Mountain?  
5     The USGS made some rather extensive measurements on  
6     Yucca Mountain Proper which indicates that there's  
7     very, very significant air flow in and out of the  
8     Mountain even if you have no drifts and tunnels. Was  
9     that taken into account in the natural ventilation  
10    analysis?

11                  MR. FEDORS: No. This was more scoping  
12    analyses -- what if ventilation was -- I don't think  
13    the Department of Energy has any -- I don't know what  
14    their stance is on ventilation after forced  
15    ventilation period is. We think that might be  
16    important, and we are looking at models now to first  
17    let's get the natural ambient condition right with  
18    drifts, and then if there's a thermally perturbed  
19    through buoyancy effects, that you would have  
20    ventilation from that in between the ambient and the  
21    thermal -- rather the force ventilation at the onset.

22                  MEMBER LEVENSON: Well, the USGS also  
23    measured barometric pumping --

24                  MR. FEDORS: Yes.

25                  MEMBER LEVENSON: -- and a number of other

1 phenomena, and it was very extensive.

2 MR. FEDORS: Yes. We're looking into some  
3 of those very reports right now to kind of help us  
4 bound -- create boundary conditions and tell us  
5 whether it's reasonable for the air flow, because it's  
6 difficult to get air flow out of that, you're just  
7 monitoring the pressure.

8 CHAIRMAN HORNBERGER: Questions from  
9 staff? Anyone else? Thanks very much, Randy. Let's  
10 see, where are we? We are on the near-field --  
11 evolution of the near-field environment. Oh, did I  
12 skip one? Oh, yes, okay. I didn't mean to skip you,  
13 Paul. I didn't mean to skip you, Paul, but, again,  
14 I'll let you introduce yourself for the record.

15 MR. BERTETTI: Okay. Hopefully everyone  
16 can hear me just fine. My name again is Paul  
17 Bertetti, and I'll talk a little bit about  
18 radionuclide transport. Part of this project is  
19 experimental in nature too, so this morning I  
20 conducted a couple of experiments on the slipperiness  
21 of the ice and the hardness of the concrete, and my  
22 preliminary results are that the ice is slippery and  
23 the concrete is hard.

24 MEMBER LEVENSON: That's project  
25 confirmation.

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1 MR. BERTETTI: That's right. Well, I'll  
2 do some more of that tomorrow morning.

3 Well, my outline is the same as many of  
4 the previous ones. We'll talk a little bit about  
5 status of subissue resolution here with respect to  
6 transport -- what we're doing, what we think DOE and  
7 we need to do in the future.

8 Radionuclide transport just looks at  
9 processes that control radionuclide migration, both in  
10 the unsaturated part of the system and in a saturated  
11 zone, outside of the area that's influenced by what we  
12 call the near-field environment.

13 We have four subissues: transport through  
14 porous rock, which is essentially that unsaturated  
15 material; transport through alluvium, essentially all  
16 saturated material; and transport through fractured  
17 rock, which incorporates both the unsaturated zone and  
18 the fractured volcanic top that is saturated below the  
19 repository, and the fourth one is the nuclear  
20 criticality issue, which people haven't said much  
21 about. That's kind of -- there are several KTIs that  
22 have this criticality component. They're kind of all  
23 addressed together in one lump group, so I won't say  
24 a whole lot about that.

25 We have several agreements. I'll discuss

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1       them in detail in the following slides. Essentially,  
2       they're focused on getting information that we need to  
3       be comfortable about the processes used to model and  
4       represent radionuclide transport.

5               So we'll start with Subissue Number 1,  
6       which is the radionuclide transport through porous  
7       rock. We have five agreements. One of these is  
8       partially complete. What that means is we received  
9       some of the documentation necessary to satisfy that  
10      agreement, and that's undergone review. And we've  
11      requested a little bit of additional information.  
12      And, specifically, what we had requested was a  
13      technical basis for screening criteria of  
14      radionuclides, and I think maybe the way we  
15      communicated what we wanted to satisfy that agreement  
16      wasn't really understood by the DOE, so we've kind of  
17      tried to clarify that position so that we get a little  
18      bit more information in that respect. Four have  
19      documents that supposedly will be delivered in fiscal  
20      year 2002, given DOE's plan of action and their  
21      current resources.

22             Just specifically, one of the most  
23      important agreements that we have is kind of a very  
24      generic one and that is provide analysis and  
25      documentation of transport parameters. Essentially,

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1 a lot of the values used for KDs throughout the  
2 transport models in the system were based on expert  
3 judgment, so the particular values are derived from a  
4 very limited group of experts who kind of made  
5 estimates on what those KD values should be. Yet  
6 there's not a specific set of documents that provide  
7 traceability and justification for those values. And  
8 so what we've asked, and DOE's agreed to, provide that  
9 information to us.

10 We also have asked for providing results  
11 of the in situ field testing in the unsaturated zone,  
12 and that alludes to the stuff that Jim Winterle talked  
13 about earlier which are the alcove 8 niche 3 testing  
14 and information that we can get from unsaturated zone.

15 I will add also here that we did a lot of  
16 work in trying to come up with the language of those  
17 agreements and what we were going to ask for, and I'd  
18 say the majority of our agreements, the vast majority  
19 of our agreements, are essentially just a request for  
20 information that the DOE had already indicated that  
21 they were going to produce.

22 CHAIRMAN HORNBERGER: Paul?

23 MR. BERTETTI: Yes, sir.

24 CHAIRMAN HORNBERGER: The last bullet:  
25 Plutonium, uranium and?

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1 MR. BERTETTI: Correct.

2 CHAIRMAN HORNBERGER: You mean --

3 MR. BERTETTI: Protactinium.

4 CHAIRMAN HORNBERGER: Yes. So  
5 protactinium is an issue?

6 MR. BERTETTI: Well, this agreement comes  
7 from DOE documents that indicated that they needed to  
8 do more sensitivity studies to confirm that the data  
9 that they had for these was adequate. So they  
10 mentioned that there was some concern that the value  
11 for the unsaturated zone of porous rock, that these  
12 numbers that they had were adequate. It kind of  
13 relates to this documentation. What they had is some  
14 limited number of experiments. So what we asked for  
15 is just to continue that work and provide the  
16 sensitivity studies to see, well, do you really need  
17 to worry about this or not. And so that's what we're  
18 asking is can you provide some risk information to  
19 justify what you're using or not.

20 VICE CHAIRMAN WYMER: But that's not an  
21 indication that you really think that's a problem.

22 MR. BERTETTI: Well, we really don't know  
23 unless we have some sort of information to gauge that.  
24 Well, I mean that's part of the problem is we can make  
25 a lot -- radionuclide transport is an interesting

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1 issue, because a great many people think they know a  
2 whole lot about it in the sense of, "Well, we can  
3 model this using a KD." And the problem is there  
4 aren't too many real examples of where a KD model has  
5 been successful at predicting that actually has  
6 happened. And so what we'd like to do is get some  
7 information so we can check off the box. And I would  
8 agree with you for the unsaturated zone in this sort  
9 of transport, you're probably correct.

10 Subissue 2 is radionuclide transport  
11 through alluvium. We have a number of agreements  
12 related to this. One of them is complete. That was  
13 kind of a request for an updated features, events and  
14 processes document. One was due in October 2001.  
15 Specifically, we had requested pre-test predictions  
16 for tests conducted at the alluvium testing complex.  
17 And the idea behind that was if we could have some  
18 indication of what DOE expected to get from their  
19 field experimental results, then we would have a  
20 better way of assessing whether or not their  
21 conceptual model and their process model, on which  
22 their TSPA model was based, was adequate. We have not  
23 received that yet, but they're making progress in the  
24 testing, and ideally we'll get a testing plan in the  
25 near future. Five of them are due next year, there's

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1 another one due in the following fiscal year.

2 The alluvium is an interesting part of the  
3 transport path in that it's not very well  
4 characterized, and this kind goes to the question of,  
5 well, how much information is enough? And I guess  
6 that depends on how important that part of the system  
7 is and whether or not you feel that your  
8 characterization is sufficient to justify the way  
9 you're modeling the system.

10 And as Bret mentioned earlier, this is  
11 kind of way of -- an area where DOE and NRC have  
12 differed in the way they model the system. The  
13 saturated alluvium and saturated zone transport is  
14 somewhat important in the NRC TPA code, at least in  
15 terms of sensitivity studies, but is not very  
16 important and the unsaturated zone component is the  
17 most important for DOE.

18 So there's a little bit of disagreement in  
19 terms of importance and sensitivity and as a result  
20 you might see a little bit of difference in how much  
21 characterization might be needed. So we worked hard  
22 to get a set of agreements that satisfied both parties  
23 in the technical exchange. I'll talk about some  
24 specific information when I show -- when I discuss the  
25 work that we've done over the last year.

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1           Our Subissue 3 is radionuclide transport  
2 through fractured rock. We have a number of  
3 agreements here again. One of them is under review.  
4 That's essentially the fractured, unsaturated zone  
5 test plan that we've looked at. We'd like to get more  
6 information to provide plans for characterization and  
7 results of the in situ testing and to get information  
8 from the fractured saturated zone testing.

9           Essentially, that's the testing that was  
10 done at the Sea Wells complex. So the document that  
11 we're waiting on is essentially the Sea Wells AMR that  
12 will provide us with the results and the testing  
13 process that was done at that location. And the  
14 reason that's important is that's maybe the only field  
15 test that's done in saturated, fractured volcanic  
16 rock, so it's kind of an important, basic  
17 characterization of the system.

18           I have a bullet on for colloids so I'll  
19 mention them. Whether or not colloids are very  
20 important to dose or very important to the performance  
21 of the system is of some question; however, there's  
22 field evidence that colloids may have been transported  
23 at the Nevada Test Site, DOE has incorporated colloid  
24 modeling in their TSPA model, we are going to  
25 incorporate it in the next revision of the TPA code to

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1 help us evaluate the importance of that. So what  
2 we're asking for is a sensitivity analysis to kind of  
3 test the importance of the parameters used to develop  
4 that colloid model.

5 As I said, the criticality issue is  
6 essentially kind of combined over a number of KTIs,  
7 and it essentially involves delivery of numerous  
8 topical reports to hopefully close out that issue.

9 What does the NRC need to do before  
10 license application? Well, as mentioned over and over  
11 again today, we need to monitor DOE's progress and  
12 hopefully inform ourselves as to how they're  
13 conducting their work and whether or not it's relevant  
14 to what we think is important. And I think it's  
15 particularly important for radionuclide transport,  
16 because there's still a number of characterization and  
17 field tests ongoing. And there's a lot of basic data  
18 being collected, so we have to be particularly careful  
19 about our ability to understand what's going on, how  
20 things may or may not change during the collection of  
21 that characterization data. I think everything else  
22 is pretty self-explanatory there.

23 While this slide is not particularly  
24 useful for this meeting, but it does -- the importance  
25 here is that we spent a significant effort, like I

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1 mentioned earlier, trying to understand the risk  
2 significance and the documentation that DOE had  
3 provided before our technical exchange. We were kind  
4 of like the middle of the line, essentially, so we  
5 spent a particular amount of effort to try to get  
6 things as risk informed as possible.

7 Other things that we've done over the last  
8 year, we've collected and analyzed some actual samples  
9 from the Early Warning Drilling Project program. One  
10 of the problems with data collection and  
11 characterization is that there's a significant span of  
12 time between collection of the sample, analysis,  
13 reporting of the data so that it can be used in part  
14 of people's interpretations and models.

15 So we have to take a very proactive role  
16 collecting our data, assembling the data that has been  
17 collected and may not be readily available. For  
18 instance, one of the things that we did is we took all  
19 of the Nye County data, the data that Nye County had  
20 collected as part of their program, assembled it and  
21 put it into this document so that it could be used by  
22 CNWRA and NRC staff as part of their work.

23 CHAIRMAN HORNBERGER: Paul, but you also  
24 actually ran some samples? What's the purpose?  
25 Cross-lab confirmation testing or are you measuring

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1 something else?

2 MR. BERTETTI: Well, two things is that I  
3 can get results in a very short time period so that I  
4 can actually start working on an analysis of water  
5 chemistry from our standpoint. The other thing is  
6 that we can try to confirm whether or not the results  
7 are meaningful. Remember because these things are  
8 ongoing, QA of samples is very important. We have a  
9 way of -- it's kind of like an oversight and  
10 confirmation process.

11 The other things that we're doing that I  
12 think are pretty important are that we've tried to  
13 apply some of the process level models, especially  
14 using a surface complexation approach to evaluate an  
15 alternative mechanism for modeling radionuclide  
16 transport in the system. I think we've been pretty  
17 successful at that, and to that end we've conducted  
18 focus experimental studies to build up our own  
19 database for that and to help us provide a robust  
20 model. And we're actually -- the next revision of the  
21 TPA code should incorporate, in a limited basis, the  
22 ability to use results from our surface complexation  
23 modeling approach in our TPA code. And we'll kind of  
24 do that on look-up table basis, at least that's the  
25 indications so far. And some of what we've done there

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1 is laboratory studies of neptunium on calcite. I'll  
2 talk about that in a minute.

3 And a good example is some analysis of  
4 technetium uptake on clinoptilolite, which is kind of  
5 a material that can substitute for alluvium. And the  
6 fact was at one point DOE had claimed some minor  
7 credit for technetium sorption. Our results indicated  
8 that that was probably in the experimental noise, and  
9 DOE, on further analysis, acknowledged that, yes, that  
10 was essentially experimental noise.

11 Okay. So here are some examples of  
12 information that we can gather from our own analysis  
13 and collection of materials. This, for instance, is  
14 a sample of alluvium collected from one of the Early  
15 Warning Drilling Project wells, showing that there's  
16 maybe some fine-grain codings on some of these grains.  
17 And some recent studies have indicated that maybe with  
18 these kind of codings they actually drive the sorption  
19 drive process, and they might be actually fairly  
20 generic and that they actually may be very much like  
21 clay. And it turns out that recent DOE results also  
22 indicate that the sorption of alluvium is kind of  
23 driven by the presence of clay above maybe anything  
24 else. And you can also start to group well water  
25 chemistries, not only with respect to depth in the

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1 saturated zone but spatially as well. So that's some  
2 important things that we can do, and then we can be  
3 prepared for the next step of characterization and  
4 modeling.

5 VICE CHAIRMAN WYMER: What's the size of  
6 that grain, Paul?

7 MR. BERTETTI: I'm sorry, this slide right  
8 here is about two millimeters across.

9 VICE CHAIRMAN WYMER: Oh, it's that big?  
10 Okay.

11 MR. BERTETTI: Yes, sir. So here's an  
12 example of the experimental results for neptunium  
13 uptake on calcite. This is just the distribution  
14 coefficient, or KD, for neptunium and plotted against  
15 the pH or the solution. What I don't want to say is  
16 neptunium sorption on calcite is not necessarily the  
17 most important aspect of transport in the alluvium,  
18 but what's important about this is that DOE  
19 assumptions of transport of the alluvium for the TSPA  
20 VA were based on these limited results with water from  
21 UE25-p#1, which is that deep carbonate aquifer well.  
22 And, in fact, the processes that control this sorption  
23 and the magnitude of sorption are not really related  
24 to the process controlling sorption in the alluvium.  
25 In fact, now DOE has conducted some data with alluvium

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1 samples, but we're still limited to a very narrow  
2 range of pH. And so I think we have to be careful  
3 about potential invalid assumptions regarding  
4 mechanism and the magnitude of sorption.

5 And the reason that's important is that we  
6 might be able to get the magnitude right, and that  
7 might be okay. The problem is the real uncertainty  
8 and variability, both in chemistry, and the kinds of  
9 variability that we want to add to our modeling to  
10 incorporate real levels of uncertainty and realism we  
11 should be able to do a better job at the experimental  
12 part.

13 MEMBER GARRICK: Speaking of variability,  
14 and I realize you're outside the near-field, how are  
15 you accounting for the source term -- the variations  
16 in the source term, because that's certainly going to  
17 effect the radionuclide transport, is it not?

18 MR. BERTETTI: Variations in what respect?

19 MEMBER GARRICK: Well --

20 MR. BERTETTI: If you mean chemical  
21 variations in terms of a plume, those are not  
22 accounted for.

23 MEMBER GARRICK: Okay.

24 MR. BERTETTI: And they're not accounted  
25 for in either model.

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1 MEMBER GARRICK: So it's kind of  
2 idealistic. It's not really very representative of --

3 MR. BERTETTI: That's absolutely correct.  
4 And one advantage that a surface complexation model  
5 approach rather than the -- rather than providing a  
6 distribution to sample from, a distribution of KDs  
7 from which to sample, that are geared at one pH, using  
8 a distribution of KDs that have a range of real system  
9 chemistry, like CO2 and pH and other factors, well,  
10 that at least you can evaluate the uncertainty and  
11 make an argument of whether or not your plume may have  
12 a distinct chemistry from the surrounding environment  
13 or whether dilution will essentially make it into a  
14 background sort of transport system, in which case you  
15 might have a pretty realistic approach to the  
16 uncertainty.

17 MEMBER GARRICK: Yes.

18 MR. BERTETTI: By picking a KD model  
19 that's based on one pH and a distribution that's based  
20 on some experiments that don't have a really good  
21 variability in chemistry, no, I don't think that's a  
22 very effective way. But that's my opinion.

23 VICE CHAIRMAN WYMER: I'm disappointed you  
24 haven't said anything about valence.

25 MR. BERTETTI: Well, you know, I'd like to

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1 do that. I mean to me that's -- the redox state of  
2 the system is very important, and that goes to the  
3 characterization. Some people might make an argument  
4 that specific mineral surfaces might provide a micro  
5 redox environment that really would enhance sorption.  
6 The problem is if you have four wells over ten  
7 kilometers, to try to characterize that, you're not  
8 going to be able to make a defensible argument to  
9 support that.

10 The other thing I would add is that, Neil,  
11 I've added these little dots between the red and the  
12 green, so those of you who are red/green challenged  
13 should be able to see that graph.

14 MEMBER LEVENSON: Before you take that off  
15 --

16 MR. BERTETTI: Yes, sir.

17 MEMBER LEVENSON: -- I'm intrigued by,  
18 looking at your red circle, the influence of time --  
19 seven days, 14 days, 21, 31 days -- because all of  
20 those are infinitesimally short in the time constant  
21 of what we're looking at.

22 CHAIRMAN HORNBERGER: It keeps going up  
23 for 10,000 years, you think?

24 (Laughter.)

25 MEMBER LEVENSON: Well, the question is

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1     how valid are the yellow ones if they were instantly  
2     measured?

3             MR. BERTETTI: Well, the factor is that  
4     these, over the same time period of the red dots, stay  
5     constant. I didn't mention that specifically, and  
6     that's in a difference in the mechanism of sorption.  
7     In this system, we start out with the water that's  
8     essentially saturated with respect to calcite, so you  
9     have a surface reorganization of the calcite and some  
10    precipitation that goes on, and that kind of enhances  
11    the uptake of neptunium. And we've kind of confirmed  
12    that with our own co-precipitation experiments.

13            Whereas, if you have a system that's  
14    undersaturated with respect to calcite, like the  
15    alluvium -- saturated alluvium is now, you have  
16    essentially kind of this stable sorption --  
17    equilibrium sorption curve that you get with silicate  
18    minerals and other minerals too.

19            So I mean it's a big -- it's not  
20    insignificant that we have a similar sort of sorption  
21    curve shape with a carbonate mineral that we do with  
22    aluminum silicate. So the problem is over a long  
23    period of time we could have a significant change in  
24    chemistry and mechanism of uptake and processes, and,  
25    frankly, that's not incorporated. Temporal changes

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1 are not incorporated.

2 So what are we planning to do? Well,  
3 obviously, we'd like to keep up with DOE documents and  
4 the products that they contribute over the next year.  
5 We'd like to continue to prioritize our modeling and  
6 analysis so that we're looking at hopefully the right  
7 issues and the risk prioritized features. To that  
8 end, what we're going to do is we're going to continue  
9 some focused experimental studies, we're also going to  
10 look at our field characterization activities and  
11 evaluations.

12 One thing I would mention is DOE has a  
13 major effort and going down to the natural analog site  
14 at Pennyblanca, and we're going to participate in that  
15 in terms of observation and maybe some sampling and  
16 confirmation activity as well. We'll continue with  
17 these neptunium results to include some modeling and  
18 hopefully build a more robust database for ourselves.

19 We're doing some sensitivity analysis and  
20 colloidal transport modeling on our own to look at the  
21 kinetics of that system, and maybe we find that it  
22 might be actually driven by kinetic process. I think  
23 at the recent MRS meeting some German investigators  
24 looked at neptunium sorption on human colloids and  
25 found that it was very much kinetically controlled.

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1 And we'll also report some additional results on some  
2 detailed modeling of processes.

3 In summary, we've just looked at risk  
4 informed. I think we do a good job providing some  
5 independent technical investigation, and we're trying  
6 to maintain our risk-informed approach to the work  
7 that we do. And that's all I have.

8 CHAIRMAN HORNBERGER: Thank you, Paul.  
9 Milt?

10 MEMBER LEVENSON: I asked them along the  
11 way.

12 CHAIRMAN HORNBERGER: Raymond?

13 VICE CHAIRMAN WYMER: I had a couple,  
14 Paul.

15 MR. BERTETTI: Yes, sir.

16 VICE CHAIRMAN WYMER: One, with respect to  
17 the KDs, you said that a lot of it was expert  
18 elicitation of derived -- that's where DOE got a lot  
19 of results. There weren't many really experimental.

20 MR. BERTETTI: Correct, especially for the  
21 volcanic top, porous material.

22 VICE CHAIRMAN WYMER: Then you said that  
23 DOE's going to tell you how they got their results.  
24 Does that mean they're going to tell you how they ran  
25 their expert elicitation or does that mean they're

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1 going to go out and get more results?

2 MR. BERTETTI: Well, I would characterize  
3 it like an expert judgment, and I think the idea is  
4 they have expressed a desire to provide documentation  
5 information about how those expert judgments were  
6 derived.

7 VICE CHAIRMAN WYMER: So that's what it  
8 meant.

9 MR. BERTETTI: And if they cannot do that,  
10 then that could become an issue. So that issue is  
11 probably minor unless that documentation doesn't  
12 exist, and then it might be a major effort for them to  
13 provide the adequate documentation.

14 VICE CHAIRMAN WYMER: Documentation on how  
15 you do an expert elicitation isn't nearly as  
16 convincing as documentation on experimental --

17 MR. BERTETTI: That may be correct.

18 VICE CHAIRMAN WYMER: Well, that's one  
19 point. You know, I'm sure, and I know you know, that  
20 NRC has --

21 MR. BERTETTI: Well, I wouldn't be so  
22 sure.

23 VICE CHAIRMAN WYMER: You'll know you know  
24 in a minute.

25 (Laughter.)

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1 NRC has a very nice research program on  
2 mechanisms of radionuclide transport going underway.  
3 You were at the working group meeting where they  
4 discussed that. I gather from what you said in the  
5 course along the way that it is the result -- those  
6 results are those kinds of results that are going to  
7 be used to check the results obtained by KD values.  
8 Did you not imply that in one of your viewgraphs?

9 MR. BERTETTI: Well, I think what we'd  
10 like to do is for nuclides like neptunium that might  
11 have a small but variable retardation coefficient is  
12 that to actually incorporate our surface complexation  
13 modeling results and put them into the TPA code, and  
14 then have the TPA code sampled the natural variable  
15 parameters like pH and CO2 to produce an output and  
16 then compare that to the sampling of KD in which you  
17 have a distribution of KD that's not dependent on the  
18 real -- the advantage of that is we can go out in the  
19 field and measure pH and pCO2 and determine a real  
20 system variability, which is something that we can  
21 measure, and it's kind of hard to measure the  
22 probability distribution and function of KDs  
23 independent of that, which is what is essentially done  
24 now.

25 VICE CHAIRMAN WYMER: And, finally, with

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1 respect to protactinium, it probably, in the entire  
2 periodic table, is the element most prone to  
3 hydrolysis. I've worked some with it; it's terrible,  
4 it's a terrible material. So if you're going to  
5 discuss protactinium and its transport, you're  
6 probably talking about a colloid other than any sort  
7 of ionic format.

8 MR. BERTETTI: I would agree with that  
9 entirely. Every time we do a neptunium experiment  
10 with neptunium 237, we essentially do a protactinium  
11 experiment as well, because the immediate daughter is  
12 protactinium 233. And so we kind of get a little bit  
13 of information about how protactinium is behaving in  
14 the system, and I would say that my very preliminary  
15 indications are that protactinium is sorbed  
16 significantly, and that's very consistent with our  
17 studies of actinides to show that when they start to  
18 hydrologize that's when you start to see a significant  
19 sorption.

20 VICE CHAIRMAN WYMER: Right.

21 MR. BERTETTI: So except for competing  
22 anions and other complexes, I would expect  
23 protactinium to have a significant sorption potential.

24 MR. BRADBURY: Yes, this is John Bradbury,  
25 NRC. With regard to your questions concerning expert

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1 judgment, first of all, it was our -- DOE and their  
2 labs have collected a lot of sorption data for man  
3 years. I was our understanding that the use of the  
4 expert judgment was mainly with regard to establishing  
5 distributions to be applied in performance assessment,  
6 and so we were looking for the explanation concerning  
7 how the distributions were --

8 VICE CHAIRMAN WYMER: I guess I don't  
9 really understand what you just said, because  
10 distribution is the whole ballgame on KDs.

11 CHAIRMAN HORNBERGER: Probability.

12 VICE CHAIRMAN WYMER: Probability  
13 distribution.

14 MR. BRADBURY: Probability distribution as  
15 opposed -- since there's a limited number of  
16 experiments that are done and how are those  
17 represented out spatially and temporally?

18 VICE CHAIRMAN WYMER: Oh, okay. I  
19 understand now. All right. Thanks.

20 MR. BRADBURY: So that was one thing I  
21 wanted to --

22 MR. BERTETTI: I would agree with that,  
23 and I'd also temper that, that there are some nuclides  
24 that are not -- weren't well studied. I mean there's  
25 a little bit of minor nuclides that may not be

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1 important that didn't have a lot of experimental basis  
2 behind them.

3 MR. BRADBURY: Yes. Can I expand on that  
4 a little bit? The three radionuclides that have been  
5 mentioned, the plutonium, uranium and protactinium, I  
6 believe in our earlier issue resolution status report  
7 and the agreements that we came up -- we established  
8 in those, there are certain assumptions that have to  
9 be shown to be valid for KDs to apply to  
10 radionuclides. And for plutonium, uranium and  
11 protactinium, there were certain aspects of those  
12 experiments that created problems, and so they are  
13 going to go -- for example, with regard to plutonium,  
14 one of the assumptions should be that the sorption  
15 process should be fast, and there were indications  
16 that their sorption experiments that the KDs were  
17 changing with time, that kind of situation.

18 CHAIRMAN HORNBERGER: John?

19 MEMBER GARRICK: I'm not a chemist, as  
20 you'll find out in a minute, or a geochemist or  
21 something, but I guess I'm wondering why this is a  
22 KTI. There's no question --

23 MR. BERTETTI: DOE has mentioned that as  
24 well. DOE had a suggestion that the radionuclide  
25 transport KTI would be rolled into one large KTI that

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1 would essentially be called flow and transport,  
2 primarily because that's how they have organized their  
3 system. I think it's important -- why is it a KTI?  
4 I think there a lot of aspects of radionuclide  
5 transport that take a lot of resources to address the  
6 --

7 MEMBER GARRICK: Well, don't get me wrong.  
8 I think radionuclide transport is important. What I'm  
9 confused by a little bit is the decoupling of the work  
10 that's going on from what I would call a  
11 scientifically based source term that has tremendous  
12 impact on the radionuclide transport. And the absence  
13 of temporal effects makes me wonder, this program, as  
14 it's outlined, what its relevance is, because things  
15 are really going to be very different in a couple  
16 process sense.

17 MR. BERTETTI: Well, I'm not sure I can  
18 answer that. What I would say is I think that there  
19 are temporal changes in terms of the magnitude and the  
20 value of the source term. I don't think there are  
21 temporal changes applied with respect to chemistry,  
22 and I think that's one of the things that was a  
23 comment from our TPA review, the peer review of our  
24 TPA code. We tried to address those.

25 I think there is a -- personally, I think

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1 that there is a disconnect between whether or not you  
2 try to envision transport within some sort of plume  
3 that has an isolated geochemistry or whether or not  
4 you have mixing and how temporal effects on flow  
5 change chemistry. So I really don't know how to  
6 answer that. I would say that I kind of agree that  
7 there seems to be a disconnect there, and I really  
8 don't have another answer other than that. Bret is  
9 eager to pipe in.

10 MR. LESLIE: Partially, I think Paul --  
11 this is Bret Leslie from the NRC staff -- Paul was  
12 careful when he said where RT kicks in. Beyond the  
13 point of coupled processes.

14 MEMBER GARRICK: Right.

15 MR. LESLIE: So we're talking far field  
16 now.

17 MEMBER GARRICK: Yes. He did say that.

18 MR. LESLIE: And I think that's part of  
19 the answer to your question is RT is looking at the  
20 ambient conditions in the far field.

21 MEMBER GARRICK: Yes, and therefore my  
22 reaction is so what?

23 VICE CHAIRMAN WYMER: The implication is  
24 that even if you have a coupled effect and you produce  
25 something different from what you're going to find in

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1 the far field, that like a valence change, that that  
2 will then occur as you move away from the near-field,  
3 that you'll get back to the species that you're  
4 looking at. That's the implication of what you're  
5 saying, I believe.

6 MR. LESLIE: Well, I know. The other  
7 thing is, again, we had that flow-down diagram, and  
8 you have to answer the complete system. We have to  
9 represent the natural system, and radionuclide  
10 retardation is part of that natural system.

11 MEMBER GARRICK: Well, I agree with that.  
12 I agree with all of that, that radionuclide  
13 retardation is something that probably isn't accounted  
14 for to the extent that it should be. And all I'm  
15 suggesting is that any time -- I've had lots of  
16 experience with source terms of a different type  
17 having to do with nuclear power plants and what have  
18 you, and we couldn't get anywhere until we had done a  
19 pretty good job of defining the source term, because  
20 you have no idea of what kind of release dates you're  
21 dealing with. And until you can define the release  
22 dates, you have no real good technical basis for  
23 calculating any off-site consequences, et cetera.

24 And I think there's a similarity here,  
25 even though the mediums are very different, and I even

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1 know in WIPP that there was a tremendous amount of  
2 effort, especially late in the program, in trying to  
3 define the source term. And I suspect we're going to  
4 hear about that when we hear about the near-field  
5 work, but I do see a real disconnect in what we've  
6 heard this afternoon with respect to radionuclide  
7 transport.

8 MR. LESLIE: This is Bret Leslie again  
9 from the NRC staff. I think Gustavo actually covered  
10 it but in a minor sense because of the focus of the  
11 container life and source term is both container life  
12 and source term. That source term does define what  
13 those downstream releases are and to the effect that  
14 the near-field chemistry also influences that, but he  
15 didn't dwell on it that much. And, again, in terms of  
16 risk information, it's the container that is where  
17 most of the insights derive.

18 MEMBER GARRICK: Yes. Yes, I understand  
19 that. Okay. Thank you.

20 CHAIRMAN HORNBERGER: Just to make sure  
21 that I'm clear on this, I want to make sure that it's  
22 not a disconnect in a bad sense. I mean John is  
23 saying it's a disconnect, but it's only a true  
24 disconnect if in fact you're working off on the source  
25 term here and you're working on radionuclide transport

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1 completely independently of that, and I don't think  
2 that's what you're doing, is it?

3 MR. BERTETTI: No. I guess what I might  
4 add is that if you make a reasonable assumption that  
5 there's a significant amount of mixing in the  
6 saturated zone with respect to kind of equalizing a  
7 distinct chemical signature that the source term would  
8 have, then our approach is I think very sound. And it  
9 is coupled in that nature, because we can account for  
10 the chemical variability in the natural system outside  
11 of that altered area of the near-field.

12 The problem might lie in that if you have  
13 a very distinct near-field chemistry that perpetuates  
14 itself in the natural system, then our current  
15 characterization of the natural system may not  
16 adequately represent the transport characteristics  
17 from that. And results from our near-field studies  
18 and modeling and from the source term should help us  
19 identify whether or not the magnitude and the volume  
20 of material is released essentially would have that  
21 kind of characteristic.

22 So it's something that needs to be  
23 evaluated as we learn more about how the near-field  
24 chemistry responds, and right now that's one of the  
25 large areas of uncertainty is what's happening in the

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1 waste package in and around the waste package  
2 chemistry? And I don't want to step on what Bobby  
3 might say, but that's a high degree of uncertainty.  
4 And so until we get a better handle on what that  
5 chemistry is and how that responds as we have some  
6 infiltration, then I think it's very tough to couple  
7 anything.

8 CHAIRMAN HORNBERGER: I guess, just to  
9 pursue this, not too much farther, but it strikes me  
10 that if you have massive changes propagating  
11 themselves, what you're basically going to have to  
12 conclude is that the near-field extends all the way to  
13 the saturated zone. I mean, to me, the far field, by  
14 definition, you're into sort of trace amounts.

15 MR. BERTETTI: Right, right, right. I  
16 just want to say that you could have a trace amount of  
17 chemistry, and I don't know how that would effect the  
18 system overall. I would agree with you on that, yes.

19 CHAIRMAN HORNBERGER: Okay. Milt?

20 MEMBER LEVENSON: I think, George, to some  
21 extent, all of the KTIs are really independent. You  
22 take the pieces and that's what the modeling and the  
23 code -- just like the corrosion didn't discuss that  
24 it's probably irrelevant if there's no water, from the  
25 standpoint each KTI, to some extent, is completely

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1 independent. They have to depend on the other  
2 operations to put them together.

3 CHAIRMAN HORNBERGER: Right. And that's  
4 what I -- in my introductory remarks, I pointed out  
5 that one of the things we were interested in is how  
6 the KTIs link together to make sure that in fact they  
7 are being integrated. Anything else? Staff? Thanks,  
8 Paul.

9 MR. BERTETTI: Sure. I'm not sure if I  
10 would have wanted to be skipped or --

11 (Laughter.)

12 CHAIRMAN HORNBERGER: That was a -- well,  
13 I guess at the GSA meeting the year before last, I was  
14 chairing a session and did exactly the same thing. I  
15 was going down the list and actually introduced a  
16 speaker out of order, and I was accused by the speaker  
17 I skipped of having a senior moment. So that's okay  
18 if you do that. And, Bobby, I'll let you introduce  
19 yourself, as I have for the other people, for the  
20 record.

21 MR. PABALAN: My name is Roberto, or  
22 Bobby, Pabalan. I have listed in my first viewgraph  
23 the people who have contributed to this KTI of  
24 evolution of the near-field environment, or ENFE. And  
25 if you have any questions, please feel free to ask

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1       them.

2                       (Laughter.)

3               And I will also try to answer your  
4       questions. The ENFE KTI -- this is the outline for my  
5       presentation, which is pretty much the same as the  
6       previous ones, so I'm going to skip this. The ENFE  
7       subissues, there are five of them, each pertaining to  
8       the effects of coupled processes. The first one  
9       pertains specifically to the drift seepage and flow.  
10      The second one pertains to the waste package chemical  
11      environment. The third one is on the chemical  
12      environment for radionuclide release. And the fourth  
13      one is on radionuclide transport in the near-field.  
14      And the fifth one is on the effects of coupled THC  
15      processes on potential nuclear criticality in the  
16      near-field.

17               At the start of fiscal year 2001, four of  
18      them, the first four were open, the fifth one was  
19      closed-pending as of the start of the fiscal year. At  
20      the end of fiscal year 2001, all of these are closed-  
21      pending as a result of the NRC/DOE technical exchange  
22      that was held sometime in January of last year.

23               Now, we wanted to show what DOE needs to  
24      provide before license application. Well, the most  
25      important thing is they need to decide on the

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1 repository design and the thermal operating mode. As  
2 we all know, the materials -- the repository design,  
3 the materials that go into the repository and the  
4 temperature conditions under which these materials are  
5 exposed to are the main drivers for the coupled THC  
6 processes.

7 So, in essence, the DOE needs to update  
8 the evolution of the near-field environment process  
9 models and the TSPA model abstractions to be  
10 consistent with the selected design and the thermal  
11 operating mode, whether they go to high temperature or  
12 the low temperature operating mode.

13 The analyses that we have conducted in the  
14 past year are based on AMRs and PMRs that basically  
15 relied on the high temperature operating conditions.  
16 So if there's any change in the design or in the  
17 operating mode, then we need to review any new  
18 information or changed information that will come in.

19 The DOE also needs to provide additional  
20 information as a result of the agreements we had at  
21 the technical exchange. There are 41 agreements as a  
22 result of the technical exchange. That's a long  
23 laundry list. Fourteen of those have been received,  
24 and we expect to receive 27 sometime in this fiscal  
25 year. Although it's a long list, many of them are

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1 relatively straightforward. For example, it ranges  
2 from providing sufficient technical basis for some of  
3 the FEPs that have been excluded from the abstraction  
4 all the way to more complex requirements dealing with  
5 data uncertainty, model uncertainty and model  
6 validation.

7 We don't expect these agreements to  
8 present a problem in terms of fulfilling the  
9 agreements prior to the license application. I think  
10 many of them are straightforward. I wouldn't be  
11 surprised, though, that some of them may actually be  
12 completed in the post-LA period, specifically with  
13 respect to model validation and also those pertaining  
14 to the analysis of the model uncertainties, the  
15 implementation of those uncertainties and the  
16 propagation of these uncertainties in the TSPA  
17 calculations, as well as in the analysis of the  
18 uncertainties in the data supporting these model  
19 calculations.

20 I'm going to give just a few examples of  
21 the more important agreements for each of the  
22 subissues. For Subissue 1, which pertains to the  
23 coupled THC processes on drift seepage and flow, the  
24 DOE needs to address the various sources of model and  
25 data uncertainty in its THC abstraction. One of the

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1 agreements that we came to at the tech exchange was  
2 that DOE needs to provide physical evidence that  
3 supports the model of matrix/fracture interactions,  
4 specifically the facts on precipitation processes.  
5 The DOE is supposed to provide data on the post-test  
6 overcoring. I believe this pertains to the single  
7 heater test. And also they need to provide the  
8 results of ongoing sidewall sampling for the drift  
9 scale heater test. Some of the information I believe  
10 has been provided. Most of these results are still to  
11 be expected for this fiscal year 2002.

12 For Subissue 2, which pertains to the  
13 waste package and drip shield chemical environment,  
14 Gustavo pointed out of the need for the DOE to provide  
15 a good handle on the quantity and the chemistry of  
16 water contacting the drip shield and the waste  
17 package. Because the chemistry and the quantity  
18 determines the performance of the drip shield and the  
19 waste package materials. As you all know, the  
20 performance of the waste package and drip shield is a  
21 key safety attribute of the DOE safety case. The DOE  
22 needs to place bounds on the concentrations of the  
23 minor and trace elements which are important to  
24 performance, for example, fluoride in the case of the  
25 titanium alloy drip shield. The DOE needs to evaluate

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1 the effects of evaporation or salt deposition or the  
2 interaction with engineered materials on the chemistry  
3 of the water contacting the drip shield and the waste  
4 package surfaces.

5 In addition, for Subissue 2, DOE needs to  
6 document the data, including the uncertainties, used  
7 to calibrate the models or to support model  
8 predictions. And they also need to propagate the data  
9 and the model uncertainties through the TSPA  
10 calculations.

11 With respect to Subissue 3, which is the  
12 effects of coupled THC processes in the chemical  
13 environment for radionuclide release, again, as  
14 Gustavo pointed out and that Leslie alluded to, the  
15 DOE needs to reduce and/or quantify the uncertainties  
16 in the chemistry of water inside the waste package,  
17 because it affects directly the degradation of the  
18 cladding as well as of the waste forms. In addition,  
19 our review of the DOE reports indicate that the DOE  
20 colloid concentration model is extremely sensitive to  
21 the in-package chemistry. The DOE also needs to  
22 provide analysis to verify that the bulk-scale  
23 processes dominate the in-package chemical  
24 environment, which is the main assumption in the DOE's  
25 in-package abstraction.

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1           In addition, again, they need to document  
2 the data, including uncertainties used the support the  
3 in-package chemistry calculations as well as provide  
4 stronger technical basis for the radionuclide and  
5 waste form types selected for the colloid release  
6 models.

7           For Subissue 4, pertaining to radionuclide  
8 transport in the near-field, I think the things that  
9 DOE needs to do are relatively straightforward. They  
10 just need to provide the technical basis for screening  
11 out coupled THC effects on the radionuclide transport  
12 by diffusion of colloids. They also need to  
13 demonstrate the suitability of the colloid models and  
14 parameters for conditions in a perturbed near-field  
15 environment, because there are abstractions basically  
16 based on conditions under -- basically based on  
17 ambient condition assumptions. If DOE also implements  
18 retardation in the waste package or in the engineered  
19 barrier system, as appears to be the case in the SSPA,  
20 then they will need to provide the technical basis for  
21 the transport parameters they use for the in-package  
22 -- for the waste package transport and EBS transport.

23           For Subissue 5, on the potential  
24 criticality in the near-field, all they need to do is  
25 they need to close the open items remaining in the NRC

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1 safety evaluation report with respect to the disposal  
2 criticality analysis methodology topical report. And  
3 they also need to revise the FEPs screening arguments  
4 concerning criticality. So those are fairly  
5 straightforward.

6 So what does the NRC and Center staff need  
7 to do before LA? Obviously, we need to keep on top of  
8 the DOE progress with respect to fulfilling the  
9 technical exchange agreements. We need to review the  
10 DOE data collection and model activities used to  
11 support its process and abstracted models. We need to  
12 continue independent evaluation of issues through a  
13 focused and experimental modeling program. I'm going  
14 to talk about some of those activities in the next few  
15 viewgraphs. We need to maintain in-depth familiarity  
16 with DOE methods and assumptions, models and model  
17 abstractions, and we also need to be prepared to  
18 respond to changes in the DOE safety strategy and the  
19 repository design or in the process abstracted models.  
20 And we also need to validate our own codes that we use  
21 to review the DOE safety case.

22 For FY 2001, we have basically spent most  
23 of our time conducting an intensive and critical  
24 review of DOE documents related to a near-field --  
25 various reports, technical basis documents, SER, SSPA

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1 and AMRs and PMRs. We conveyed -- we contributed to  
2 NRC reviews of these documents and helped convey NRC  
3 concerns to the DOE staff in various technical  
4 exchanges and in numerous pre-tech exchange  
5 teleconferences, and also in addition to the  
6 teleconference and sufficiency review. We helped  
7 identify risk-formed paths through resolution of NRC  
8 concerns, resulting in the status of the first four  
9 ENFE subissues being changed from open to closed-  
10 pending. We also documented our review and the status  
11 of subissue resolution in the integrated IRSR report  
12 that's going to come out sometime this year.

13 MULTIFLO is a coupled THC model that's  
14 being used by NRC and Center staff for various KTI  
15 activities, including near-fields, thermal effects on  
16 flow, USFIC and TSPAI KTIs. For the past fiscal year,  
17 development of version 2.0 was initiated. Version 1.5  
18 was released, which includes new features, including  
19 free-drainage boundary condition and improved  
20 description of the fracture-to-matrix flow processes.  
21 We also developed a graphical user interface for  
22 MULTIFLO and a workshop training was held here at  
23 Whiteflint for NRC staff.

24 In addition to the MULTIFLO work, we  
25 conducted focused application of process-level models

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1 to test DOE hypotheses pertaining to the deliquescence  
2 points of salt mixtures that can deposit on the drip  
3 shield and waste package surfaces. We also looked at  
4 the chemical evolution of our Yucca Mountain  
5 groundwaters that can result due to evaporation. We  
6 also conducted focused experimental studies to study  
7 deliquescence points of mixed salt systems, as well as  
8 studies relating to uranophane solubility.

9 This last bullet on the uranophane  
10 solubility is a preliminary step towards conducting  
11 neptunium core precipitation experiments. This is one  
12 of those activities that we stopped two years ago,  
13 because in a TSPA-SR report it was apparent that the  
14 DOE would not claim credit for secondary phase  
15 precipitation.

16 It is now evident from the SSPA reports  
17 that they might actually take credit for such  
18 processes. So, again, doing a risk-informed type of  
19 approach, we determined it was important to reinitiate  
20 or redo -- start again the uranophane solubility  
21 experiments and the follow-on work, the neptunium core  
22 precipitation work.

23 The next two viewgraphs basically show the  
24 results of those process modeling work. This  
25 particular study was designed to test the DOE

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1 hypothesis. The DOE, in its abstraction of the  
2 chemistry of water on the waste package and drip  
3 shield surface, assumed that aqueous corrosion begins  
4 when the relative humidity reaches the deliquescence  
5 relative humidity of pure salt. In the TSPA-SR  
6 report, they assumed -- they used the sodium nitrate  
7 deliquescence humidity as a lower bound for the  
8 deliquescence point of salts that could form in the  
9 waste package drip shield surface.

10 Our thermodynamic calculations are shown  
11 in these figures. These calculations were done for a  
12 temperature of 90 degrees centigrade, a temperature  
13 which can be sustained for about 1,000 years or more  
14 based on RTEF calculations. These systems are for  
15 brine or mixtures of two salts. The Figure A is for  
16 NaCL plus KCL; the second one is for NaCL plus  
17 magnesium chloride, and the third one is for KCL and  
18 magnesium chloride. The solid curves are the  
19 calculated deliquescence humidities for the mixed  
20 solids. The dashed line is plotted as a reference.  
21 It gives the deliquescence humidity for pure sodium  
22 nitrate at 90 degrees centigrade.

23 Basically, the bottom line of the  
24 calculations suggest that, okay, if you have sodium  
25 chloride plus potassium chloride mixture, then it's

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1     okay to use a pure sodium nitrate deliquescence  
2     humidity as your bounding point for the deliquescence  
3     point of the mixture. On the other hand, if you have  
4     a magnesium chloride mixture with NaCl or KCl, and  
5     also in essence with calcium chloride, which is  
6     another salt that has very low deliquescence humidity,  
7     then it's not appropriate to use a pure sodium nitrate  
8     salt as a lower bound for the deliquescence part  
9     because of the salt mixture.

10             In the SSBA, it indicates that DOE is also  
11     looking at using the magnesium chloride and calcium  
12     chloride properties as an estimate for the  
13     deliquescence point for the salt mixtures. So I think  
14     there is improvement in the DOE approach that's  
15     evident from the more recent information.

16             So the question then is, okay, what kind  
17     of salts can form on the waste package and drip shield  
18     surface? One mechanism by which we can form these  
19     salts is by evaporation of Yucca Mountain pore waters  
20     that drip into the drift environment. What we've done  
21     here is we've taken a few chemical compositions  
22     published by Yang et al. for Yucca Mountain pore  
23     waters. Basically, they're plotted up in the first  
24     what we call a pie per diagram, for the initial  
25     composition and the final compositions are plotted in

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1 the second pie per diagram.

2 The initial compositions really range in  
3 terms of the cationic composition -- you know, it has  
4 a very well distributed range for the calcium and  
5 sodium, potassium, magnesium chloride concentrations.  
6 And it also varies with respect to sulfate chloride  
7 and bicarbonate carbonate. When you expose these  
8 Yucca Mountain pore waters to evaporated  
9 concentration, what you form are basically two types  
10 of brines.

11 Some of the initial Yucca Mountain pore  
12 waters evolve into what can be called a calcium,  
13 magnesium, sodium chloride brine. These brines, if  
14 you take it to full evaporation, will form salt  
15 deposits with very low deliquescence points, basically  
16 because of calcium and magnesium. But what is also  
17 important is that you form very low concentrations of  
18 the corrosion-inhibiting species.

19 The nitrate -- this is the free nitrate  
20 concentration accounting for the -- this is the  
21 uncomplexed nitrate concentration. It's less than  
22 0.01 molar. The total nitrate concentration in  
23 solution can be very large, but the free nitrate  
24 concentration is constrained by the formation of  
25 calcium nitrate ion pair complexes in solution.

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1 Sulfate is constrained by precipitation of calcium  
2 sulfate during the evaporation process. On the other  
3 hand, you can have Yucca Mountain pore waters evolve  
4 into potassium, sodium chloride nitrate brines.

5 Now, the deliquescence points of salt  
6 mixtures that can form from these brines will have  
7 relatively higher deliquescence points than those that  
8 form from the calcium magnesium brines. But on the  
9 other hand, they're still going to be lower than those  
10 of the pure sodium nitrate salt. These salts have  
11 much higher free nitrate concentrations, hence you can  
12 have possible waste package corrosion inhibitor. On  
13 the other hand, where you have some amount of fluoride  
14 initially in the solution, upon evaporation, in this  
15 case I think it evaporated to about 15,000 times  
16 concentration factor, you can have very high  
17 concentrations of fluoride. In one particular case,  
18 about 0.014 molar, which is much greater than the  
19 0.001 molar threshold for accelerated general  
20 corrosion of titanium alloy, which is observed in some  
21 of the Center experiments.

22 For FY 2002, our plan is basically to  
23 review the DOE documents relevant to near-field  
24 subissues. We will continue those process-level  
25 modeling work that may have been conducted. Those are

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1 supported by some experimental studies because there's  
2 really no experimental data on the deliquescence point  
3 of salt mixtures at elevated temperatures. I have a  
4 backup slide, I believe Number 2, that demonstrates  
5 some of those results. We will continue to develop  
6 MULTIFLO version 2 with enhanced capability to  
7 simulate coupled THC processes. MULTIFLO will be used  
8 to predict the quantity and chemistry of seepage water  
9 and to help quantify uncertainties associated at the  
10 process level and PA simulations for complex coupled  
11 processes. We plan to validate these process-level  
12 models that we have used in reviewing the DOE  
13 analysis, and we will provide input to the integrated  
14 IRSR rev 1.

15 So in summary, for the past fiscal year,  
16 like I said, we've spent quite a bit of work in  
17 conducting a critical evaluation of the DOE analysis  
18 relevant to near-field subissues. We have interacted  
19 with the DOE to resolve NRC concerns, resulting in all  
20 ENFE subissues becoming closed, pending confirmation.  
21 We continue to develop MULTIFLO, and we've conducted  
22 some process-level modeling and experimental studies  
23 which are designed to probe DOE assumptions regarding  
24 processes judged to be the most risk-significant.  
25 That's all I have, and I'll take your questions.

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1 CHAIRMAN HORNBERGER: Thanks, Bobby. Ray,  
2 you want to start?

3 VICE CHAIRMAN WYMER: Yes, I'll start. I  
4 think you'd probably agree that the chemistry of the  
5 near-field and especially the chemistry in the package  
6 is extremely complex and especially with regard to  
7 potential solid phase formation. And I just wondered  
8 if the thermodynamic database available for your  
9 modeling is anywhere near adequate to deal with all  
10 the potential phases that could form and tie up some  
11 of these things?

12 MR. PABALAN: With respect to the pure  
13 phases, there might be enough information to allow us  
14 to do the evaluation. But there are certainly more  
15 complex solid solutions and things like that where we  
16 don't have any information. Can we use better  
17 thermodynamic data? Certainly.

18 VICE CHAIRMAN WYMER: But you feel what  
19 you have is adequate to the task.

20 MR. PABALAN: It will allow us to evaluate  
21 trends in the evolution and the chemistry of not only  
22 water outside the waste package but also inside the  
23 waste package.

24 VICE CHAIRMAN WYMER: Okay. The second  
25 question I had is I was -- just kind of an

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1 observation. I was a little bit surprised to hear you  
2 say that you thought that the calcium nitrate ion  
3 pairs are sufficiently strong that they would  
4 significantly reduce the nitrate ion -- free nitrate  
5 ion concentration.

6 MR. PABALAN: Yes. You're not the first  
7 one to ask me that, and I've done a literature search  
8 on calcium nitrate. There are a couple of what we  
9 consider multiple lines of evidence. There are some  
10 indirect measurements of water activities or osmotic  
11 coefficients and some more direct, like x-ray  
12 diffraction analysis of calcium nitrates, which  
13 suggest that you do form strong calcium nitrate,  
14 especially at the higher concentrations which is of  
15 interest to us. That's a review that I'm still doing.

16 I also have some random spectroscopy  
17 literature that I just got precisely to address the  
18 potential for -- whether it's true, whether calcium  
19 nitrate does form strong complexes. But the  
20 indications are, yes, it does. I don't know if it's  
21 greater to the extent that is suggested by the  
22 thermodynamic modeling. That's something that we will  
23 pursue in the next few months.

24 VICE CHAIRMAN WYMER: Yes, I'm skeptical.  
25 Okay.

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1 CHAIRMAN HORNBERGER: Milt?

2 MEMBER LEVENSON: I've got, I guess, two  
3 questions, and it's more maybe to determine whether  
4 they're included in your scope or not included in your  
5 scope. In the near-field, you've discussed the  
6 chemistry. Where are the mechanical assumptions  
7 reviewed? And by that I mean things like the  
8 corrosion of the waste container is going to occur  
9 here and not there. The thing at one of the modelings  
10 that we came across said the minute you penetrate and  
11 the container is no longer vacuum-tight, you make the  
12 assumption that 50 percent of the surface of the  
13 container is gone. There's a lot of mechanical  
14 assumptions in the near-field that are in the  
15 modeling. Is the review of those things under your  
16 area or is that somewhere else?

17 MR. PABALAN: We help review the DOE  
18 approach to these kinds of calculations. We don't do  
19 independent analysis, whether experimental or  
20 modeling, with respect to that, although we provide  
21 some input in the TSPAI type of analysis, which kind  
22 of puts these things together. We're more focused on  
23 the chemistry aspect versus the mechanical type of  
24 information.

25 MR. LESLIE: This is Bret Leslie from the

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1 staff. If Bobby moves a little bit that way, it's  
2 important to remember that when we developed our  
3 sufficiency comments, we took -- we may have five KTIs  
4 reviewing the same AMR, and they're reviewing it under  
5 their KTI, but we're providing integrated comments.  
6 So the answer to your question is, no, the mechanical  
7 things aren't necessarily reviewed by the near-field,  
8 but they're either reviewed by the container life and  
9 source term or the repository design and thermal  
10 mechanical effects.

11 MEMBER LEVENSON: My question was were  
12 they included here and the answer is no, right?

13 MR. LESLIE: That's correct.

14 MEMBER LEVENSON: Okay. The second  
15 question is a similar one, whether it's included here  
16 or not, and that is the assumptions in the modeling in  
17 the near-field of how water behaves. In some of the  
18 models, there's kind of strange behavior for water in  
19 that water vapor moves independent of -- pressure  
20 moves only on a gradient of temperature, so you don't  
21 lose any water from the rock into the drift. It all  
22 moves away. Now, there are similar things that are  
23 assumed assumptions without evidence in the modeling  
24 but in the near-field. Is that also somewhere else?

25 MR. PABALAN: Subissue I pertaining to

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1 seepage and flow addresses specifically that issue,  
2 but it is not -- well, it is but not in the -- it's  
3 not considered in the modeling activity that I  
4 discussed with respect to the --

5 MEMBER LEVENSON: Somewhere else.

6 MR. PABALAN: Yes, it's done somewhere  
7 else.

8 CHAIRMAN HORNBERGER: John?

9 MEMBER GARRICK: Well, just a comment. By  
10 the number of agreements, one might get the impression  
11 that as far as the near-field goes, DOE did very  
12 little right. And yet I've always had the impression  
13 that this is where a lot of effort was given. Is it  
14 possible that this is a product of what one might call  
15 the lamp post syndrome, because there was quite a bit  
16 of work done there is an opportunity for searching for  
17 more details? I'm just struck by the amount of -- the  
18 number of agreements that are involved here. It's  
19 just --

20 MR. PABALAN: I would disagree with your  
21 characterization that the DOE did very little. In  
22 fact, it could be the lamp post effect. It's evident  
23 since the publication of the TSPA-VA and subsequent  
24 reports that the DOE has significantly improved their  
25 THC models and model abstractions for the near-field

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1 environment.

2 MEMBER GARRICK: Well, maybe that's the  
3 problem. Maybe it's the timing is what -- what's the  
4 cutoff time for these 41 agreements, I guess is what's  
5 --

6 MR. PABALAN: The tech exchange was held  
7 January, second week of 2001. So we -- I believe we  
8 had some teleconferences prior to that, so I suppose  
9 we completed our reviews a month before the tech  
10 exchange. So that was the cutoff. The 41 agreements,  
11 as I pointed out, most of them -- many of them are  
12 straightforward, just asking for technical basis for  
13 excluded FEPs, give us the FEPs database, give us the  
14 ET-36 input files. So, essentially, most of them are  
15 relatively straightforward to fulfill.

16 MEMBER GARRICK: Okay. Well, the timing  
17 answers part of it, because you had on there a lot of  
18 information about propagation of uncertainty, and I  
19 know there's been quite a bit of that sort of work  
20 done in the last year.

21 MR. PABALAN: Yes.

22 MEMBER GARRICK: Yes. Okay.

23 CHAIRMAN HORNBERGER: Other questions?  
24 Staff? Comments? Okay. We're going to take a 15-  
25 minute break.

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1 (Whereupon, the foregoing matter went off  
2 the record at 3:08 p.m. and went back on  
3 the record at 3:25 p.m.)

4 CHAIRMAN HORNBERGER: The meeting will  
5 come to order. If I have my schedule right now, we  
6 have three remaining presentations on KTI, and the  
7 next one is on repository design and thermal-  
8 mechanical effects. Don't run away. You ready? And  
9 I'll let you introduce yourself, for the record, as  
10 everyone else.

11 MR. OFOEGBU: My name is Goodluck Ofoegbu.  
12 I'm going to present -- do the presentation on  
13 repository design and thermal-mechanical effects.

14 The presentation follows the same outline  
15 as others have followed, but some of the issues of  
16 resolution talk about what needs to be done before  
17 license application. There are actually -- there used  
18 to be four subissues, but the fourth one has been  
19 resolved, and we've essentially taken it off the list.  
20 All of the components of Issue Number 1 is resolved,  
21 and the components of Issue Number 2 also have been --  
22 is closed-pending. Issue Number 3 is where I'm going  
23 to -- well, Issue Number 2 actually is an input to the  
24 first component of Issue Number 3. So I'm going to  
25 concentrate my discussion on these three.

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1           There is a component that deals with  
2   repository design which really is part of the  
3   preclosure that has been discussed along with other  
4   aspects of the -- possibility aspects of the  
5   repository, and that's why I happen to be talking  
6   about it. And then there are two components of  
7   Subissue 3 that led to the post-closure repository  
8   performance that is rockfall and drift collapse and  
9   their longtime hydrological properties. And all of  
10   these issues -- all of these components are closed-  
11   pending because of the technical exchange meeting --  
12   the results of the technical exchange meeting that was  
13   last week.

14           On repository design, we have agreements  
15   that deal with essentially the inputs, the design and  
16   analysis. The first one is about seismic topical  
17   report 3, which is going to be the time histories of  
18   ground -- which -- that should be applied for the  
19   design of subsurface facilities and surface  
20   facilities. That report is supposed to be -- they've  
21   postponed a number of times. It's supposed to be  
22   delivered finally in January of this year and is  
23   probably on its way as I speak, I believe.

24           The properties of ground support, the only  
25   issue here is that -- the only concern, I should say,

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1 is that DOE wants to exclude corrosion of ground  
2 support -- possible corrosion of ground support  
3 material during the pre-closure period. And the  
4 argument for that is that we don't want that to cause  
5 cooling corrosion or obvious corrosion. All they need  
6 to consider is dry air oxidation and to get rid of  
7 that is very slow for -- and will not cause  
8 appreciable corrosion for 300 years.

9 And we asked them to produce a technical  
10 basis to support this position on humidity. They have  
11 in fact submitted a report on that. We've looked at  
12 the report, and we are in the process of getting back  
13 to DOE on it. The one thing I can say is that we are  
14 not convinced that a satisfactory case has been met to  
15 exclude corrosion of ground support materials for the  
16 200 or so years of the pre-closure period.

17 On rock properties, DOE approach is to use  
18 the Yucca Mountain fracture data to obtain values of  
19 rock mass in this list that can then be used to get  
20 the mean values of rock mass properties that are used  
21 in design. And that is a valid approach except that  
22 we are not convinced that DOE has done enough to  
23 define the uncertainties. For example, Yangs Modulus  
24 controls the stress. It is possible on the analysis  
25 to go from a favorable analysis result to highly

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1 unfavorable analysis result by changing the value of  
2 the Yangs Modulus.

3 So one of the things we want to know is  
4 within which range is it -- I mean what are the range  
5 of things of Yangs Modulus for each quality value.  
6 The same thing applies to the rock's strength  
7 parameters. Of particular concern here is also that  
8 quality in the -- the practice of using quality  
9 indices to characterize rock mass actually tries to  
10 account for the face of fractures and not the face of  
11 spherical discontinuities like the lithophytes which  
12 are caused over more than 70 percent of the proposed  
13 repository horizon.

14 So we asked DOE to provide an analysis of  
15 what the approach is for dealing with lithophyzing.  
16 And DOE has agreed to do this, along with all the  
17 analysis that they need to do for our properties.  
18 They are going to look at the information they have,  
19 analyze it and then decide that that is necessary and  
20 then compile all of this in the design analysis -- I  
21 mean design parameter analysis report that should be  
22 submitted sometime within this year. And we believe  
23 that if they do all that, that the information  
24 presented is likely to be sufficient for review.

25 Then the DOE intends to use rock mechanics

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1 analysis to demonstrate that the -- all the ground  
2 openings will be stable through the pre-closure period  
3 to support the pre-closure and all the things that are  
4 required. And that is, again, a good approach. It  
5 could be supplemented with a maintenance plan, but  
6 that hasn't been discussed.

7 But in the analysis there are several  
8 things that -- several analysis approaches that we  
9 found unsatisfactory. For example, to specify  
10 boundary conditions, how they are specified. For  
11 instance, in the seismic loading, they were using it  
12 in a certain way that is based on the zero  
13 acceleration. But the ground motion is characterized  
14 by a time history that contains multiple frequencies.  
15 And they argued that this approach is satisfactory,  
16 except that we have not seen the basis on some kind of  
17 testing or some kind of modeling that says that these  
18 two systems of loading I approve of them. Then  
19 conduct some sensitivity analysis and submit a report  
20 of the analysis by I think it's 2003, so that's not  
21 coming this year.

22 On post-closure, the first is rockfall and  
23 drift collapse. Not included in performance  
24 assessment, the point is cleaned out using a  
25 combination of design and probability. For rockfall,

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1 DOE wants to design -- DOE wants to select a design  
2 basis rock impact and design the drip shields and  
3 waste packages to withstand such rock impact, and then  
4 argue that the probability of larger impacts will --  
5 what's happening? I thought you could hear me.

6 PARTICIPANT: You didn't turn it on.

7 MR. OFOEGBU: Oh.

8 PARTICIPANT: You've been talking very  
9 load.

10 MR. OFOEGBU: Oh, really? Okay. The  
11 problem is I can get too loud now.

12 (Laughter.)

13 Okay. So they want to design the drip  
14 shield and waste package to withstand the design basis  
15 rock impact and then argue that larger impacts -- the  
16 probability of larger impacts is below the regulatory  
17 limit. And we believe that this approach is valid.  
18 There are a number of things, the way that they define  
19 the design basis rock impact, both the size and  
20 frequency. We had problems with that. We had problem  
21 with how they conduct analysis to demonstrate a drip  
22 shield and waste packages will withstand impact. We  
23 also have problem with the probability of larger  
24 impacts. But the approach that DOE has selected  
25 should lead to a resolution of these if things are

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1 carried out satisfactorily. And there is no reason  
2 why they cannot be carried out satisfactorily.

3 Where we have considerable doubt about the  
4 DOE approach is in drift collapse. DOE wants to prove  
5 that the placement drifts are not going to collapse  
6 for 10,000 years. And all of the analyses that we  
7 have done at the Center, all of the information  
8 available from underground rock engineering experience  
9 and in fact even advice provided by DOE's own expert  
10 panel on emplacement drift stability lead us to  
11 believe that the emplacement drifts are likely to  
12 collapse soon after the cessation of maintenance.

13 And because of that we are not able to  
14 anticipate that a satisfactory technical basis can be  
15 developed to support the DOE position that emplacement  
16 drifts will not collapse. Instead we anticipate a  
17 satisfactory case can be made by considering the  
18 magnitude of these potential effects of drift collapse  
19 and maybe making an argument based on the magnitudes  
20 of propagation of those magnitudes where necessary to  
21 the ultimate performance measure, which is dose. And  
22 that such an argument will leave considerable room for  
23 resolution of the concern. But an argument that is  
24 based on the drifts maintaining the integrity for  
25 10,000 years, even without ground support, is going to

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1 be very difficult to assert.

2 On long-term hydrological properties,  
3 again, the main concern here is that there is -- the  
4 thermal loading will induce rock failure in the pillar  
5 areas, and there are analysis results that indicate  
6 that this is possible. And such rock failure would  
7 cause the dilation, the opening up, of the horizontal  
8 fractures, and that may cause diversion of water from  
9 the pillar to the drift area. DOE has agreed to look  
10 into this and the analysis that we expect will resolve  
11 this concern will be submitted sometime in 2003.

12 Well, what the analysis intends to do to  
13 support all this? We'll review DOE documents and  
14 continue interactions with DOE. There is one meeting  
15 that we were going to hold sometime about October or  
16 November last year to look at their plan for  
17 implementing some of their agreements, but the meeting  
18 got postponed, and we are hoping that that kind of  
19 meeting will be held in the near future.

20 We also expect to conduct our own  
21 independent analysis to support our review of the DOE  
22 documents and to assess risk significance. We are  
23 doing these analysis to examine -- to look at the  
24 effects of rockfall impact on the design of drip  
25 shields and waste packages and to look at the effects

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1 of drift collapse on the drip shields and waste  
2 packages, on seepage into drifts and on waste package  
3 temperature. We will also do some scoping size --  
4 block size distribution analysis that will evaluate  
5 DOE's design basis rock size and the frequency of  
6 beyond design basis rock size, if I might use that  
7 kind of expression.

8 This is one of the analysis we conducted  
9 to evaluate the previous drip shield design. At that  
10 time, the design basis rock size was supposed to be  
11 13,000 kilograms, and this analysis tested the design  
12 to look at the response of the drip shield on the  
13 design -- on the rock impact of 8,000 kilograms.  
14 Okay. And what we found was that the drip shield --  
15 that particular design wouldn't be able to perform its  
16 functions on the rock impact of -- an impact by an  
17 eight-kilogram rock. And we found that this result  
18 actually can be modified by changing the boundary  
19 conditions.

20 The analysis that the DOE did previously  
21 met certain assumptions about it -- connections of how  
22 the base of the drip shield is connected and all that.  
23 And by looking at the impacts of this, we were about  
24 to decide among us that that particular design would  
25 not be good to satisfy the rock impact that was the

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1 design basis at that time. But I think DOE people are  
2 aware of these and we have been told that the  
3 assumptions is maybe in the design or maybe in the  
4 design basis rock, but we haven't seen where the  
5 change will be.

6 Okay. We're also going to do analysis to  
7 try to evaluate block size distributions that will  
8 enable us to do an evaluation of DOE's design basis  
9 rock size. We're also going to look at the assumption  
10 of our seepage. Currently, what is happening in DOE's  
11 performance assessment is that 95 percent of the  
12 water that contacts that would go through the drift  
13 footprints, which is an area of 5.5 meters times I  
14 think 5.23 meters in the drift direction, that the  
15 amount of moisture that heats that area 95 percent,  
16 almost 95 percent of that moisture is directed around  
17 the drift because of the capillary barrier around the  
18 drift opening.

19 The capillary barrier arising from -- if  
20 water heats an opening -- water tries to intersect an  
21 opening around such a medium, the water is going to  
22 flow around -- flow along the surface of the solid.  
23 So the tendency to flow into the opening is reduced  
24 and only about five percent of the water is actually  
25 going through. On the other hand, if you look at this

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1 block size, the solution comes from a simulation that  
2 was done at the Center. This is just one realization  
3 that could be obtained from the Yucca Mountain  
4 fracture that -- they are all realizations, so this is  
5 just one example.

6 But if you apply the same concept of water  
7 flowing parallel to the surface of a solid, you are  
8 going to quickly conclude that instead of moisture  
9 diverting around, that in fact a lot of the moisture  
10 are going to be diverted along fractures and  
11 eventually find their way to the opening.

12 So the capillary barrier assumption that  
13 is currently in the DOE TSPA model and also in the  
14 analysis TPA needs to be modified to account for the  
15 potential effects of drift collapse on seepage. We  
16 are going to be looking at that. It's not going to be  
17 easy, but we hope that it can done.

18 There are other potential effects of drift  
19 collapse. This was just shows that there is a  
20 variability of the kind of results that may be  
21 expected, different types and degrees of drift  
22 collapse. This one, for instance, would be at the  
23 early stages of collapse or maybe a collapse in the  
24 relatively stable rock that has very little fracture  
25 control. This will be early stages in vertical

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1 fracture control, final stages of that. And the kind  
2 of thing we can expect from horizontal fracture  
3 control, the collapse.

4 Each of these is going to effect the  
5 mechanical load on the drip shield or waste packages.  
6 They will also effect the temperature. In this case,  
7 for instance, you see that heat -- there is room for  
8 -- the only way that heat is transpired from here to  
9 there is by radiation, but here it's going to account  
10 as some kind of insulating effect from the rock around  
11 it. So we think that these effects need to be  
12 evaluated, and if it is necessary carried forward to  
13 performance assessment.

14 In 2002, there will be many reviewing  
15 DOE's reports, at least those that I expected. We'll  
16 be trying to make input to the TPA 5.0 code on the  
17 mechanical failure of drip shields and waste package,  
18 input to IRSR on the independent analysis for  
19 DECOVALEX. Analysis participation in DECOVALEX is in  
20 important. In fact, it is true DECOVALEX that we'll  
21 be able to decide with confidence that the thermal  
22 properties of in-tact rock can be used to characterize  
23 conductive heat flowing in a rock mass. So that's one  
24 valuable contribution, and that's why we continue to  
25 support that.

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1 In 2001, most of our accomplishments are  
2 really related to the technical exchange and to the  
3 participation in DECOVALEX. Thank you.

4 CHAIRMAN HORNBERGER: Thank you very much.  
5 Milt, questions?

6 MEMBER LEVENSON: Yes. I have one.

7 MEMBER GARRICK: Microphone.

8 MEMBER LEVENSON: I have one question on  
9 the -- where you asked for the providing of seismic  
10 loads, the NRC is sending out for public comment 10  
11 CFR Part 72, which is geological and seismological  
12 characteristics for siting and design of dry cask  
13 independent spent fuel storage installations. Is  
14 what's being done here consistent with that since that  
15 seems to be a very advanced stage?

16 MR. OFOEGBU: I'll let Raj handle that  
17 question.

18 MR. NATARAJA: This is Raj Nataraja, NRC  
19 staff. Part 72 is a very focused rulemaking just for  
20 the ISFSI and NRS, and they had full options under  
21 consideration, one of them being consistent with what  
22 we are doing in Part 60 and 63. And they changed  
23 their approach, and now they're going with a single  
24 2,000-year return period earthquake, which they  
25 believe is consistent with the risk level for the

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1 ISFSI. However, for the repository, we have the  
2 topical report approach where we have agreed on two  
3 different levels of earthquakes -- Category 1 DBE,  
4 Category 2 DBEs -- which it corresponds to 10,000-year  
5 and 1,000-year earthquakes. So Part 72 is not going  
6 to be doing what Part 63 is doing.

7 MEMBER LEVENSON: I guess my question  
8 really is I view the Part 72 as recognizing that the  
9 potential risk from a spent cask storage facility is  
10 not the same as that of a reactor.

11 MR. NATARAJA: That's right.

12 MEMBER LEVENSON: And, therefore, the  
13 general thinking and ground rules that go with a  
14 reactor, safe shutdown, earthquake, et cetera, are  
15 being set aside, and we're saying, "Let's tailor the  
16 seismic requirements to the potential consequences."  
17 I guess really my question is which philosophy is this  
18 based on, reactor philosophy or the dry cask storage  
19 facility?

20 MR. NATARAJA: It is neither. It is based  
21 on the repository philosophy, which is a third  
22 category, I would say.

23 MEMBER LEVENSON: But that -- okay.

24 CHAIRMAN HORNBERGER: Ray?

25 VICE CHAIRMAN WYMER: I had just a couple

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1 of things. I couldn't help but wonder why if they're  
2 designing the drip shield to withstand a rockfall  
3 impact, and that's part of their argument, why they're  
4 also doing that for the waste package or visa versa.  
5 If they're designing the waste package to withstand  
6 rockfall, why the drip shield?

7 MR. OFOEGBU: Well, actually we have asked  
8 the same question. It's not yet clear whether the  
9 drip shield is being designed to protect the waste  
10 package from rockfall impact. What it appears is that  
11 at this point the function of the drip shield is to  
12 protect it from dripping water, and so in analysis  
13 then we are going to look at the possibility of a drip  
14 shield actually contacting the waste package during  
15 the deformation episode. We are going to look at the  
16 waste package carrying some static load and then  
17 vibrating on the seismic load, a number of things like  
18 that.

19 VICE CHAIRMAN WYMER: Second question is  
20 how is it assumed that the rocks fall? Do they fall  
21 flat? Do they fall on an edge? Do they fall on a  
22 point?

23 MR. OFOEGBU: Well, those are all  
24 possibilities. The previous DOE analysis actually  
25 assumed they fall flat, and it's one of the things

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1 that we were not happy about, and there is an  
2 agreement item under the technical seal list area to  
3 consider point impact.

4 VICE CHAIRMAN WYMER: Point impact is what  
5 you're using.

6 MR. OFOEGBU: That's one of them. Point  
7 impact, line impact, surface impact are all  
8 possibilities, so those have all been --

9 VICE CHAIRMAN WYMER: And you're looking  
10 at all of them; is that what --

11 MR. OFOEGBU: Yes, yes.

12 VICE CHAIRMAN WYMER: And, finally, you  
13 said at one point toward the end there that heat  
14 transfer is only by radiation from the drip shield to  
15 the drift wall. What happened to convection?

16 MR. OFOEGBU: Well, convection too, but  
17 it's mostly radiation.

18 VICE CHAIRMAN WYMER: The whole thing  
19 doesn't hit you too hard that those temperatures --

20 MEMBER LEVENSON: It's hard to believe  
21 it's mostly radiation at these low temperatures.

22 MR. OFOEGBU: Okay. The point that -- let  
23 me now go into it. The point there is that when the  
24 drift is filled with broken rock, the role is  
25 radiation is going to be removed and you're going to

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1 have conduction through broken rock and maybe  
2 convection through the pore space that is still  
3 available.

4 VICE CHAIRMAN WYMER: That's all I have.

5 MR. AHN: Can I --

6 CHAIRMAN HORNBERGER: Tae Ahn?

7 MR. AHN: Yes. Tae Ahn, NRC staff.  
8 Regarding the rockfalls, CNSTE is coordinating with  
9 IDTME. The staff member at the Center who is working  
10 on is Dr. Goody, and I believe DOE threat is to avoid  
11 any waste package failure by rockfall. The primary  
12 barrier to prevent the rockfall failure is drip  
13 shield. Therefore, they tried to design drip shields  
14 to withstand the rockfall. Nonetheless, Dr. Goody  
15 raises several detailed questions, including rockfall  
16 effect on the waste package.

17 PARTICIPANT: That's sort of go back.

18 MR. AHN: Yes, that's what we did. The  
19 second one is in his analysis by Dr. Goody he also  
20 raised the point of contact. We raised that issue in  
21 the preclosure tech exchange as well as IDTME tech  
22 exchange with DOE.

23 CHAIRMAN HORNBERGER: John?

24 MEMBER GARRICK: Tae Ahn just answered my  
25 question. I'm in good shape.

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1 CHAIRMAN HORNBERGER: Okay. Other  
2 questions, staff? Thanks very much Goodluck.

3 MR. OFOEGBU: Okay. Thank you.

4 MR. NATARAJA: Let me just add one more  
5 thing to the question related to the seismic design.  
6 The Part 72 considers a 20-year design life, whereas  
7 we are talking about 100 years preclosure right now  
8 for design purposes. That is one major difference.  
9 And the quantity of waste is another difference  
10 between the two. And because we had this topical  
11 report agreement with DOE, we are not going to make  
12 changes based on what Part 72 is doing. We are  
13 expecting Part 72 to be doing what we are doing  
14 originally, but because of some of the exemption  
15 requests that they had, they took this approach. And  
16 we are working with them closely. We are not  
17 inconsistent with what they are doing. In terms of  
18 risk space, we are quite similar.

19 CHAIRMAN HORNBERGER: Okay. We're going  
20 to hear about preclosure.

21 MR. DASGUPTA: Good afternoon. My name is  
22 Bis Dasgupta. I'm here to present to you the  
23 preclosure aspects of the RDTME KTI. I would like to  
24 first acknowledge the contributions of the NRC and the  
25 Center staff. From the number of participants, you

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1 can guess that there has been quite an increased  
2 activity on the preclosure in the past year.

3 This is the outline of this presentation.  
4 The format of this presentation is similar to all  
5 other KTIs that you have been hearing so far, so I'm  
6 not going to go through this list again. The summary  
7 of issue resolution status, staff had their first  
8 technical exchange and management meeting with DOE on  
9 the preclosure safety. It was held on July of 2001.

10 Preclosure safety was divided into ten  
11 topics consistent with the Yucca Mountain review plan,  
12 and each of those topics were further divided into  
13 subtopics. Selected subtopics under some of these  
14 topics were discussed at the technical exchange.  
15 Based on the discussions, NRC and DOE have reached a  
16 number of agreements on selected subtopics.

17 The next three slides actually summarizes  
18 the ten preclosure topics that DOE needs to address  
19 before the license application. The subtopics and key  
20 concerns and the number of agreements that has been  
21 reached. The total number of agreements were about  
22 nine, and in addition to these agreements there were  
23 three position papers that were developed by NRC. I'm  
24 not going to go through the details of these three  
25 slides, but I would like to, however, point out that

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1 the identifications of these subtopics and concerns  
2 were based on limited, focused, risk-informed review.  
3 And some of the concerns were of higher level or  
4 general in nature, and some of them were specific.

5 More concerns will be identified with  
6 ongoing review, and those concerns will be discussed  
7 in the coming technical exchanges that we plan to have  
8 with DOE. And all topics -- we will have concerns on  
9 all topics, including those listed over here.

10 What does DOE need to provide before LA?  
11 The list that you will see in this slide and the next  
12 slide is actually based on the July technical  
13 exchange. First of all, DOE will revise the flow  
14 diagram that defines the preclosure safety analysis  
15 methodology that incorporate and consider both  
16 internal and external events in the preclosure safety  
17 analysis process.

18 As regards the naturally occurring and  
19 human-induced hazards and initiating events, NRC has  
20 discussed only two hazards in this technical exchange.  
21 One was aircraft crash hazard, and the other is  
22 tornado missile impact on the waste package. NRC has  
23 pointed out that the exclusion of aircraft crash  
24 hazard as a potential hazard in the preclosure period  
25 is kind of premature. NRC stated that DOE should

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1 provide detailed analysis taking into account all  
2 types of aircraft flying in the vicinity, including  
3 the reasonable projections of the future activity.  
4 Flight modes of military aircraft and combat training  
5 aircraft should also be included in their analysis.  
6 DOE will assess these hazards and will provide updated  
7 reports on the aircraft crash hazard analysis.

8 DOE will also assess their evaluation of  
9 the tornado missile impact on waste package. These  
10 were the two agreements that were reached on the  
11 hazards during the technical exchange.

12 In the future technical exchange, we will  
13 discuss the operational hazards in nearby industrial  
14 and military hazards, fire hazards and any other  
15 hazards for which we've completed a review and have  
16 the concerns ready to discuss with DOE.

17 The third bullet is the justification of  
18 screening and categorization of event sequences. DOE  
19 plans to eliminate event and event sequences from the  
20 preclosure safety analysis based on the design of  
21 structure system components important to safety. NRC  
22 indicated that the DOE process of elimination of  
23 events and event sequences must be consistent with the  
24 risk-informed performance-based philosophy and should  
25 be screened based on probability consequence.

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1           The second point on this one is that DOE  
2           presented their event sequence analysis with a point  
3           estimate of probability of component failure. NRC  
4           indicated that DOE probability should consider  
5           uncertainty distribution in their event sequence  
6           analysis. However, the mean value of the event  
7           sequences can be used for categorization of these  
8           event sequences. Categorization means Category 1 and  
9           Category 2 even frequencies.

10           The consequence analysis of Category 1  
11           event sequences were also discussed in this technical  
12           exchange. NRC has reviewed DOE evaluation of those  
13           calculations to public for Category 1 and Category 2  
14           event sequences, developed the position paper,  
15           accepting the overall approach of the methodology for  
16           the public dose calculation and the compliance with  
17           the performance objective.

18           In addition to the analyzed dose approach,  
19           which DOE is using for performance objective, for  
20           showing the compliance with the performance objective,  
21           NRC has pointed out that DOE should also look into the  
22           individual event dose limits, and that they should  
23           comply with the regulatory dose limits. And also  
24           consider multiple events occurring in a single year,  
25           and that multiple event dose should also be complied

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1 with the dose limits. One of the important outcomes  
2 of the preclosure safety analysis and also requirement  
3 of Part 63 is that the structure system components  
4 important to safety should be identified.

5 Number 2, topics that were discussed  
6 during the technical exchange. One is the Q list, and  
7 the other is the quality level categorization that was  
8 presented by DOE. Two agreements were reached in this  
9 area. One was that DOE will modify the procedure QAP  
10 2-3 to identify and categorize structure system  
11 components involved with the safety, to include the  
12 risk insight gained from the preclosure safety  
13 analysis. DOE will also provide guidance document for  
14 conduct of preclosure safety analysis. These were the  
15 two agreements reached under the structure system  
16 components important to safety.

17 The design information of structure system  
18 and components important to safety, there were three  
19 aspects that were discussed. One was a preclosure  
20 criticality issue, burn-up credit, waste package drop  
21 of numerical modeling and waste package fabrication  
22 process. DOE will provide updated preclosure  
23 criticality analysis and resolve the burn-up credit.  
24 There was an agreement on that. As regards the waste  
25 package, DOE will provide additional information on

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1 final modeling of waste package drop analysis, for  
2 example, the mischaracterization, boundary condition,  
3 failure criteria used. This was one agreement that  
4 was reached.

5 The waste package fabrication, staff had  
6 several questions on the welding and fabrication of  
7 waste package performance, and there were three  
8 agreements that were developed during the preclosure  
9 technical exchange meeting.

10 What does NRC need to do before LA? One  
11 aspect of work is to assess DOE issue closure. DOE  
12 will provide the data model analysis as part of the  
13 agreement, and our job is to review that DOE has  
14 fulfilled the agreements or not. Complete development  
15 of PCSA tool. This is a tool that we are working on  
16 to review DOE preclosure safety analysis. Develop  
17 confirmatory hazard identification and failure rate  
18 database. Review DOE documents on preclosure safety  
19 analysis. We will perform limited analysis using the  
20 preclosure safety analysis tool or any other modeling  
21 that we're required to do in order to satisfy us that  
22 the DOE's calculations are in the right direction.  
23 Conduct NRC and DOE technical exchange on remaining  
24 preclosure topics. Those concerns, as I said, will be  
25 raised as the review progresses. Prepare preclosure

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1 section of integrated issue resolution status report.  
2 That's an ongoing process.

3 Overview of fiscal year 2001 activities  
4 and accomplishments. As I just said, NRC and DOE has  
5 just completed -- not just -- but in July they  
6 completed the first technical exchange. We discussed  
7 12 topics, subtopics, and nine agreements were  
8 reached. Preclosure preliminary design basis  
9 document. Integrated issue resolution status reports  
10 is under development. There were two sections that  
11 were already developed. One was on the site  
12 description, other is the design of SSC, structure  
13 system component, for subsurface facility. Currently,  
14 we are working on five other sections, and those will  
15 be available sometime during this year.

16 Preclosure tool development, this provides  
17 the capability to review DOE preclosure safety  
18 analysis, and this tool is consistent with the  
19 regulatory requirements of 10 CFR Part 63, and it is  
20 also compatible with the review matters of Yucca  
21 Mountain's review plan. This tool also has the  
22 capability to conduct independent analysis on all  
23 aspects of preclosure safety analysis.

24 We have also reviewed and looked into the  
25 incorporation of human reliability and software

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1 reliability analysis in the preclosure safety  
2 analysis. We reviewed the basic concept of selected  
3 methodologies from considerable research and guidance  
4 developed by NRC on human reliability analysis. We  
5 explored the significance of software reliability and  
6 reviewed basic concepts of methodology from research  
7 and guidance again developed by the NRC. This  
8 software reliability, I want to clarify, is that DOE  
9 is planning to use remote operations in the preclosure  
10 in the surface and subsurface facility operations, so  
11 we'd like to look into that reliability of the  
12 hardware and software in those remote operations and  
13 what sort of hazards that they can lead to.

14 Last is the development of hazard  
15 identification database. Staff is collecting  
16 information on the nearby military and the industrial  
17 facility to prepare for the review. The amount of  
18 information is substantial, and it will be complex.  
19 And this advanced activity will reduce the level of  
20 FERP required during the review of the license  
21 application. The component failure rate database that  
22 we are developing, it is primarily for the PCSA tool.

23 The work plan for fiscal year 2002, we  
24 would like to incorporate the human reliability and  
25 software reliability capabilities in the tool,

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1 primarily to review DOE's work, incorporate  
2 probabilistic safety assessment capability, improve on  
3 the existing features based on the NRC and Center  
4 staff feedback. This would be an ongoing process. We  
5 would like to fix whatever problems that we have with  
6 the tool, and this is therefore that we will devote  
7 ourselves in this year. Review DOE documents and  
8 preclosure safety analysis, including limited  
9 independent analysis, prepare for NRC/DOE technical  
10 exchange for an Appendix 7 meeting, including  
11 identification of key concerns, continued preparations  
12 of preclosure section of the integrated issue  
13 resolution report, and continue development of hazard  
14 identification database.

15 In summary, the main -- as I said, there  
16 has been quite a bit of activity in the past year. We  
17 had the first technical exchange with DOE. We  
18 continued development of the preclosure safety  
19 analysis tool, and we have also started working and  
20 developing the preclosure section of the integrated  
21 issue resolution status report. With this, I would  
22 like to answer any questions you have.

23 CHAIRMAN HORNBERGER: Thanks very much.  
24 Let me start with one that occurs to me. Has there  
25 been any recent impetus to consider hazards due to

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1 terrorist activities?

2 MR. DASGUPTA: Well, I'll have Banad  
3 answer that, because we are really following the Part  
4 63.

5 MR. JAGANATH: Right now there are -- this  
6 is Banad Jaganath, NRC staff. Right now we are only  
7 working towards the current Part 63, but I know  
8 there's been going on about the hazards thing. Tim  
9 McCartin does that because he's a Part 63 man.

10 MR. MCCARTIN: Yes. Briefly, in final 63,  
11 the Commission did speak briefly to that, and right  
12 now -- and it's really in its early stages. The  
13 Commission is reevaluating fiscal security  
14 requirements, et cetera. And right now there is no  
15 planned changes to any regulations; however, it's  
16 currently going on. We'll see what happens, if there  
17 are changes, that it be done through a public  
18 rulemaking. And it is possible. Right now there  
19 aren't particular changes in mind.

20 CHAIRMAN HORNBERGER: Thanks. John?

21 MEMBER GARRICK: It's been a while since  
22 we heard about the PCSA, that's preclosure safety  
23 assessment; is that what that is?

24 MR. DASGUPTA: The tool you're talking  
25 about?

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1 CHAIRMAN HORNBERGER: Yes, the tool.

2 MEMBER GARRICK: Tool, yes.

3 MR. DASGUPTA: Yes, preclosure safety  
4 assessment.

5 MEMBER GARRICK: And as I recall, that was  
6 pretty much quite similar to and based on integrated  
7 safety analysis method that's described in Part 70.  
8 And the analysis is focused on the event sequences and  
9 establishing likelihoods and consequences of specific  
10 sequences. Can you tell me, and the thing that we  
11 have been looking at in Part 70 is how ISA independent  
12 safety analysis, the tool that's been developed, can  
13 serve as a building block towards PRA, or QRA, if you  
14 prefer, probabilistic risk assessment. Has that been  
15 kind of the strategy with respect to PCSA is to  
16 structure in such a way that you could go to the next  
17 level without having to do a lot of things over?  
18 Number one.

19 Number two, is there an aggregation of  
20 assembly component to the PCSA model; that is to say  
21 do you aggregate or assemble the scenarios, the event  
22 sequences to some higher measure of risk?

23 MR. DASGUPTA: Yes. I think there's a lot  
24 of activities going on in that preclosure safety  
25 analysis area, in the tool development area. First of

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1 all, I'd like to say that this tool really combines  
2 the methodology that has been used in the integrated  
3 safety analysis concept and the softwares that are  
4 used in the preclosure -- or PRA business. So we are  
5 not doing anything new. It's only that we are sort of  
6 keeping all these different gradients under one  
7 umbrella.

8 And the main function the tool really does  
9 is to follow the Part 63, or the Yucca Mountain review  
10 plan, what the requirements are, for example, the  
11 hazard analysis, the natural and human-induced hazard  
12 analysis, operational hazard analysis. You know, you  
13 have all those different techniques. So we have those  
14 techniques that are already existing that pertain to  
15 the tool. Then we have the even sequence analysis by  
16 using the SOPHAEROS software that's been approved by  
17 NRC. So we could develop those models and try to  
18 analyze those even sequences and do a sensitivity  
19 analysis and uncertainty analysis using those tools.

20 And then use the consequence analysis,  
21 part of it we are using in our software, to use the  
22 consequence analysis. Then integrate all these  
23 results and try to see how the performance assessment  
24 or the performance objectives are made. Because  
25 safety assessment in preclosure has to follow the Part

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1 63 Category 1 performance objectives and Category 2  
2 performance objectives.

3 Now, answering your questions, we probably  
4 have all categories or all aspects of PRA in it. That  
5 means hazard analysis, we have even sequence analysis,  
6 we have consequence analysis. And the safety  
7 assessment with the risk insight comes -- has been  
8 built as it is required in the Part 63. Now, in this  
9 tool, we are going a little forward and trying to also  
10 do a probablistic -- you know, add the probablistic  
11 capability of the overall safety assessment in which  
12 we would look into the frequency probability  
13 distribution as well as the consequence probability  
14 distribution.

15 MEMBER GARRICK: Yes.

16 MR. DASGUPTA: And try to assess the risk  
17 as well.

18 MEMBER GARRICK: Well, I was really quite  
19 interested in whether or not it has in it the feature  
20 of being able to assemble the individual event  
21 sequences into a total representation of --

22 MR. DASGUPTA: That's what exactly it is.  
23 Yes, I mean we take all these things --

24 MEMBER GARRICK: Because the ISA doesn't  
25 quite do that.

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1 MR. DASGUPTA: No, no, no. But this tool  
2 goes farther beyond that, yes.

3 MEMBER GARRICK: Yes.

4 MR. DASGUPTA: And it goes into it and  
5 then collects all this information and then tries to  
6 assess the risk insight of these Category 1, Category  
7 2 event sequences.

8 MEMBER GARRICK: Thank you.

9 CHAIRMAN HORNBERGER: Raymond?

10 VICE CHAIRMAN WYMER: Just a point of  
11 clarification. Under the heading, "What Does NRC Need  
12 to do Before LA," one of the items there is, "Develop  
13 confirmatory hazard identification and failure rate  
14 database." And then under the next viewgraph,  
15 "Overview of Fiscal Year 2001 Activities and  
16 Accomplishments," you say, "Development of hazard  
17 identification database and component failure rate  
18 database." And then over on the next viewgraph, you  
19 say you're going to develop --

20 MR. DASGUPTA: It says, "developed."  
21 Well, it's an ongoing process, actually, because we  
22 started this component failure rate database as well  
23 as hazard identification database, and we thought that  
24 we probably have reached, but there's a lot of  
25 information out there. We are researching on it and

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1 then putting things. So it's not complete. Yes, it's  
2 an ongoing process.

3 VICE CHAIRMAN WYMER: Okay.

4 MR. DASGUPTA: And I think we would stop  
5 before LA. And this database will be helping us in  
6 reviewing the --

7 VICE CHAIRMAN WYMER: I do have a real  
8 question to follow-up. I don't think I understand  
9 what hazard identification database is. I don't know  
10 where the data come in. It seems like that might be  
11 a list, but I don't --

12 MR. DASGUPTA: Yes. Well, as I said  
13 before, and I can have -- Milt is attending from there  
14 can jump in whenever you feel like. This is  
15 collecting -- this is actually collecting information  
16 of the nearby military and industrial facility.

17 VICE CHAIRMAN WYMER: Sorry, of the what?

18 MR. DASGUPTA: Nearby military activity  
19 and the industrial activities around the Yucca  
20 Mountain area. I think there are a lot of information  
21 that we need to process before the license  
22 application, because DOE has to analyze that hazard,  
23 taking all the data into consideration. And then we  
24 are trying to do a proactive job to develop that  
25 database also, because when the license application

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1 comes, it will be very difficult within a short period  
2 to process this data and to --

3 VICE CHAIRMAN WYMER: Okay, thanks.

4 CHAIRMAN HORNBERGER: So data sometimes is  
5 more than chemical concentrations developed from  
6 spectrophotometers.

7 (Laughter.)

8 Milt?

9 MEMBER LEVENSON: Yes. I have one  
10 question and one comment, sort of, I guess.  
11 Previously, we've been told that the KTIs are  
12 relatively broad so that there's a good chance that  
13 whatever safety case DOE chooses to make, you will  
14 have it covered. You may have changed the emphasis.  
15 For the preclosure, is what's going on adequate to  
16 cover the case of whether DOE decides to use truck or  
17 rail shipment, because that makes a significant  
18 difference on the front end?

19 MR. DASGUPTA: Well, are you here looking  
20 at within the facility, because what we are looking at  
21 --

22 MEMBER LEVENSON: Yes, yes. Yes, yes.

23 MR. DASGUPTA: Yes.

24 MEMBER LEVENSON: Not the process of  
25 transportation.

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1 MR. DASGUPTA: Okay. Well, I really  
2 didn't understand your question, but can you repeat  
3 that again?

4 MEMBER LEVENSON: Yes. Previously, we  
5 were told that the information being assembled -- the  
6 whole KTI process provided you enough information so  
7 that no matter which safety case DOE came in with you  
8 would have adequate information to review that case.  
9 Some cases you wouldn't use all the information, the  
10 emphasis would be different. And my question is on  
11 the preclosure, the information that you have  
12 requested so far, would it enable you to assess a  
13 preclosure system based on trucks, and much smaller  
14 casks, therefore, or rail cars and the different  
15 issues that come up with that?

16 MR. DASGUPTA: Yes. I mean it all depends  
17 upon their operations and their structure system  
18 components that they are using. So they would have to  
19 make their safety case by whatever process --

20 MEMBER LEVENSON: Yes, yes. I know, but  
21 the question is --

22 MR. DASGUPTA: Yes.

23 MEMBER LEVENSON: -- the information that  
24 you have already asked for --

25 MR. DASGUPTA: Yes.

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1 MEMBER LEVENSON: -- in the KTIs, would it  
2 cover both cases?

3 MR. DASGUPTA: Right now? Yes, go ahead.

4 MR. LESLIE: This is Bret Leslie from the  
5 staff. You have to remember that both DOE and NRC  
6 have only recently begun preclosure in terms of  
7 preclosure safety assessment, and I think Bis did a  
8 very good job of saying of what has been provided this  
9 is what we have, and we anticipate more information --

10 MEMBER LEVENSON: Okay, okay.

11 MR. LESLIE: -- and exchanges.

12 MEMBER LEVENSON: Okay. The next is a  
13 comment, and that is you mentioned remote operations  
14 as though it was something relatively new. There is  
15 in Idaho some 40 years of experience of very high  
16 quality remote operation -- the manufacture of reactor  
17 fuel. The welding, the inspection and everything,  
18 there's a very, very extensive database on failure  
19 rates and remote operations and lots of hot cell data  
20 all over the country, but that one is QA level that is  
21 comparable to this. And I just wondered whether  
22 you're accessing that.

23 MR. DASGUPTA: Yes. I think we are just  
24 starting to work on this area and try to see what data  
25 is available and what are the processes that are

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1 available in this area.

2 CHAIRMAN HORNBERGER: Questions from  
3 staff?

4 MR. LARKINS: Yes. I just wanted to  
5 expand upon Milt's question. Is there really enough  
6 information know about the above-ground facility and  
7 stuff that you can do an adequate hazards analysis,  
8 and how do you plan to treat things like fires without  
9 knowing a little more about the design?

10 MR. DASGUPTA: Well, I mean right now we  
11 have to depend upon the level of design that DOE has,  
12 and DOE has, for instance, you mentioned fire hazards,  
13 and they have reports on fire hazards, and we have not  
14 reviewed it totally. It's in the process of review,  
15 and we didn't discuss it in this technical exchange,  
16 because we didn't -- but we plan to do it at the next  
17 technical exchange.

18 Similarly, you know, I mean, whatever the  
19 information DOE has, the level of details, and we are  
20 going to look into that and try to see that the safety  
21 case has been made based on that details. If there is  
22 lacking in details, that we feel that DOE needs to  
23 provide us more information, we will definitely ask  
24 for it. And this is the whole process of the  
25 preclosure safety analysis that we'll work through.

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1 MR. LARKINS: It will be an iterative  
2 process.

3 MR. DASGUPTA: It is iterative process.

4 MR. LARKINS: Yes. Do you have a model  
5 for fire hazards calculating loads and --

6 MR. DASGUPTA: Well, this is currently  
7 being looked into. I mean I'm not really in a  
8 position right now to expand on that.

9 MR. LARKINS: Okay.

10 CHAIRMAN HORNBERGER: Okay. Thank you.  
11 And now we come to our wrap-up, James Anderson.

12 VICE CHAIRMAN WYMER: Nothing personal,  
13 James, but I have to leave.

14 MEMBER GARRICK: We've saved all the tough  
15 questions for you, Jim.

16 MR. ANDERSON: Great. Can you hear me all  
17 right? Good. Again, my name is Jim Anderson with the  
18 NRC staff, and I'm going to try to wrap this all up,  
19 and hopefully, like I've said, you've asked all the  
20 tough questions already. Basically, what I'm going to  
21 try to do is I'm going to try to pull a lot of  
22 thoughts that people have presented and maybe pull  
23 them all together for the whole issue resolution  
24 process. And if you have any questions after that, we  
25 can get into those specific ones.

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1                   Basically, the outline for my  
2 presentation, what I'm going to try to cover is the  
3 status of all the key technical subissues. That will  
4 probably be pretty quick, because you were already  
5 given most of them. I'm just going to try to  
6 integrate them all together.

7                   Schedule and status of the KTI agreements,  
8 some current NRC staff activities -- planning future  
9 issue resolution meetings, using the risk insights in  
10 the issue resolution process, a little bit about the  
11 integrated issue resolution status report, or  
12 integrated IRSR. I know I'm scheduled to give you a  
13 brief on that I believe in April, and hopefully that  
14 document will be out by that point in time. And then  
15 a brief summary.

16                   As has been discussed in the previous  
17 presentations, we've conducted technical exchanges in  
18 all the KTIs, and we've also had one preclosure  
19 meeting, and it, like this, mentioned additional  
20 meetings are needed, because that was only like a  
21 preliminary discussion of just some of the preclosure  
22 safety topics.

23                   As a result of the meetings, the 37 key  
24 technical issue subissues are currently categorized as  
25 either closed or closed-pending, and in the backup

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1 slides I've included the definitions for closed,  
2 closed-pending and open, and I've also provided a  
3 table that lists all the key technical issues and the  
4 subissues and their current status in one place. So  
5 if you need to look at those.

6 The technical exchanges also resulted in  
7 293 NRC and DOE agreements. And the agreements cover  
8 a variety of issues -- documentation. DOE provided  
9 some information at the meetings and all we needed was  
10 the documenting of that information. We asked for  
11 additional technical basis and justification, as  
12 you've heard in a number of examples in the earlier  
13 presentations.

14 In some instances, we've asked for data  
15 files that we want to review as part of our analysis  
16 of what DOE's doing. So I guess the point I'm trying  
17 to make is I've heard a lot of discussions of the 293  
18 agreements being 293 issues, and it's really not 293  
19 issues. There's a lot less than that. Most of this  
20 is confirmation type information or just data files  
21 and things like that.

22 CHAIRMAN HORNBERGER: Jim, let me try to  
23 get a little clarification on that. Yesterday, John  
24 Garrick and I spoke with Commissioner Merrifield, and  
25 he expressed an interest in knowing from the KTIs

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1 which ones were potholes, speed bumps or road blocks.  
2 On the 293 exchanges -- or agreements, rather, how  
3 many of them would you say fell into this category of,  
4 "Please give us a data file on this or give us your  
5 data on this"? That's number one, and maybe they're  
6 potholes, I don't know. And how many of them are  
7 detailed requirements for, let's say, two years of  
8 data collection?

9 MR. ANDERSON: I really haven't look at  
10 them in that specific of detail. Probably a good way  
11 to look at those would be the chart that Bret  
12 presented in his presentation which had major --

13 CHAIRMAN HORNBERGER: Right.

14 MR. ANDERSON: I would say in those areas,  
15 the ones that are listed as major probably have the  
16 two-year testing things you're talking about there.  
17 And the ones that are listed in more of the minor  
18 category are probably just, you know, "We're  
19 interested in the data files that back up some DOE  
20 position on something like that."

21 CHAIRMAN HORNBERGER: Push a little  
22 harder. Give me your gut-level feeling. Of 293, are  
23 150 of them in this category of data files?

24 MR. ANDERSON: No. There's a lot less  
25 than that are category of the data files. I would say

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1 the majority of the agreements are -- I don't know if  
2 it was Bret or someone else in the presentation  
3 characterized them as, you know, if DOE said they were  
4 exclude something in TSPA, we wanted additional  
5 justification or technical bases for why they're  
6 excluding it. I think most of the -- and if I'm  
7 speaking, Bret, you can correct me -- but I think most  
8 of them fall into that type of category more so than  
9 the data files category.

10 CHAIRMAN HORNBERGER: Okay.

11 MEMBER GARRICK: Just carrying that  
12 onward, I guess DOE hasn't indicated any ballpark  
13 effort that's required to fulfill these agreements.  
14 And then if one knew that, you could ask, well, how  
15 many are above a certain -- some thresholds of level  
16 of effort would be very helpful in kind of grasping  
17 what we're really talking about right here, because  
18 these numbers are being used abusively around the  
19 country, that we converted a few KTIs into 300 issues  
20 very easily.

21 And it's true that a large number of them  
22 are just requests for reports and existing data and  
23 what have you, but there's probably some number, 50,  
24 that require a level of effort that maybe is multi-man  
25 year, I don't know. Some sort of a comprehension of

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1        what we are really talking about here would certainly  
2        be helpful.

3                MR. ANDERSON:    Right, and I think we'll  
4        probably get closer to that in the next several  
5        months. As Bret mentioned, he, with a number of other  
6        people, are doing the risk insights initiative, which  
7        will be some of our look at which KTIs, KTI subissues  
8        and agreements might be more risk -- have more risk  
9        than others.

10               And then also the DOE plan, when they  
11        present their plan for going from fiscal year '02 to  
12        license application and they were going to include in  
13        that how they're going to address the 293 agreements,  
14        I think that information might also add to our  
15        understanding of which ones that are going to have the  
16        most effort -- that are going to need the most effort.

17               MEMBER LEVENSON:    John, we might ask the  
18        other side of that coin: Has anybody in NRC made an  
19        estimate as to how many man years it will take you to  
20        review those 293? That you should have done for  
21        planning purposes?

22               MR. ANDERSON:    Well, I think we took a  
23        very quick look at with Bret's table. I don't think  
24        -- there's just too many variable, especially with the  
25        possible design changes and things like that. Some of

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1 the agreements could take a long time if they do one  
2 design but could take very little if they do a  
3 different design. So I think an effort like that on  
4 the NRC side I think -- I don't know if it's fruitful.

5 MEMBER GARRICK: I guess the only point  
6 here is that somehow we need to blunt the somewhat  
7 facetious interpretation of what's going on here, that  
8 we've converted ten key technical issues into 293  
9 technical issues. And that's what we're wrestling  
10 with. And I know they're not issues -- they're not  
11 technical issues.

12 MR. PATRICK: Dr. Garrick, Wes Patrick  
13 here at the Center. Perhaps a couple points I would  
14 add to that. One of the problems we seem to continue  
15 to bump into is semantics. You certainly, and I think  
16 a number of others on ACNW, are more familiar with the  
17 term of RAI, request for additional information, that  
18 comes into play once a license application has been  
19 received.

20 In my view, the agreements are much more  
21 analogous to RAIs. They're items that are necessary  
22 for the staff to receive and review to be able to  
23 reach a determination that there is reasonable  
24 assurance that the public health and safety is going  
25 to be protected in accordance with the regulation.

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1           The KTIs are considerably higher than  
2           that, and Tim McCartin could speak to this, but we  
3           worked very hard to craft Part 63 in a way that would  
4           address things in those larger lumps, if you will, of  
5           technical concern processes, groups of processes that  
6           are important to understanding the risks associated  
7           with pre- and post-closure performance of the  
8           repository.

9           I think if people were go to back and look  
10          at a typical reactor case, certainly we're very  
11          familiar with it here with regard to independent spent  
12          fuel storage installations. It's not at all uncommon  
13          for there to be scores, perhaps hundreds of requests  
14          for additional information.

15          What makes things a bit different here,  
16          and this is the second point I would make, is that the  
17          Nuclear Waste Policy Act specifically directed NRC and  
18          DOE to get some of that work done ahead of time.  
19          Hence, the introduction of terminology of agreements,  
20          meaning pre-license application sorts of requests for  
21          additional information. So I don't see these  
22          particularly unusual when they're taken in that sort  
23          of a context.

24          MEMBER GARRICK: I'm sure you're right,  
25          and all we're trying to do is to help this process of

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1 communicating with the outside world.

2 MR. ANDERSON: Thanks, Wes. All right.  
3 That's about all I had to say about the status of the  
4 key technical issue subissues. I was going to move on  
5 to schedule and status of KTI agreements. As of the  
6 end of the year, DOE submitted information pertaining  
7 to 88 of the 293 agreements. Understand this is a  
8 fluid-type process, so basically whenever they submit  
9 something or whenever we review some documents and  
10 send letters back to them, the numbers will change.

11 The DOE schedule for providing information  
12 on the remaining agreements is as indicated right  
13 there: 89 in fiscal year '02, 84 in fiscal year '03  
14 and 32 by license application. And I'm sure a number  
15 of you will add all four of those numbers up to see if  
16 they equal 293.

17 (Laughter.)

18 CHAIRMAN HORNBERGER: They don't.

19 (Laughter.)

20 MR. ANDERSON: Moving onto the next slide,  
21 for the fiscal year '02 agreements, and those I mean  
22 the agreements which were due in fiscal year '02, DOE  
23 submitted the information mostly on time. And by what  
24 mostly on time I mean is within a month of the due  
25 dates. We've reviewed probably about half of those

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1 agreements, and additional information has been needed  
2 on several of those. We're in the process of issuing  
3 three or four additional letters, which will cover the  
4 rest -- I shouldn't say the rest -- almost all of the  
5 rest of those agreements. Those should be issued  
6 hopefully within the next couple weeks.

7 For the fiscal year '02 and beyond, the  
8 agreements which are due in fiscal year '02 and  
9 beyond, DOE is currently preparing a plan to address  
10 all the agreements in its fiscal year '02 and beyond  
11 planning to LA, so we really haven't gotten too much  
12 information in fiscal year '02 yet, and I'm sure that  
13 once the plan is announced, we'll get a better idea of  
14 what to expect in fiscal year '02, '03 and beyond.

15 And the current plan, at least which was  
16 discussed at the management meeting we held with DOE  
17 in December, was that they would have their initial  
18 plan ready for discussion in the March time frame.  
19 And I think they've indicated that the whole overall  
20 process would probably go a couple months after that,  
21 but we should have some initial information during the  
22 March 2002 time frame.

23 Next area I was going to address was the  
24 current NRC staff activities. Planning future issue  
25 resolution meetings. I've been internally referring

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1 to this as round two of issue resolution. In round  
2 one, we kind of -- we've discussed all the KTIs, we  
3 tried to identify the information gaps the NRC felt  
4 needed to be filled by DOE. And during this next  
5 round of issue resolution meetings, I hope to focus on  
6 those agreements and any new information/design  
7 changes that might have come up since the last  
8 meetings and try to refine that information gap. With  
9 293 agreements, I'm sure we haven't nailed down  
10 exactly in words exactly what we want, so I think  
11 there's room for discussions between NRC and DOE to  
12 really focus on what exactly do we need.

13 And in those discussions, and I'm kind of  
14 moving ahead to the red bullet there, we're planning  
15 to have a meeting in early February to discuss future  
16 meetings -- how we're going to conduct those meetings,  
17 how we're going to use risk insights in the process,  
18 priority -- which KTI or which agreements do we want  
19 to discuss first. And also during that meeting I'm  
20 hoping we can discuss some NRC/DOE communication  
21 issues.

22 And by those I mean how we're  
23 communicating the status of current activities just so  
24 when we do get documents in, they're not surprising to  
25 us. Or when we issue reviews and stuff, they're not

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1 surprising to DOE. So that's what I'm hoping to  
2 accomplish in the early February meeting, and I  
3 already mentioned that hopefully in March we'll  
4 discuss the DOE plan.

5 And in the remainder of fiscal year '02,  
6 we'll start holding these meetings, and I think  
7 there's going to be both Appendix 7 and technical  
8 exchange type meetings. I think Appendix 7s, and I  
9 believe DOE would agree with me, may be needed more  
10 than the big formal technical exchange meetings. The  
11 Appendix 7s, the key technical people can get together  
12 and really discuss what the information needs are. So  
13 hopefully there will be a number of each of those type  
14 meetings in fiscal year '02 and as I move on to '03.

15 And in the preclosure area, like Bis  
16 mentioned earlier, we still need to have some initial  
17 meetings in that area to really iron out what the  
18 concerns or information gaps are, and DOE needs to  
19 provide us information on where they're going in that  
20 area.

21 Bret really hit this one earlier, but I'm  
22 just going to try to recap it a little bit -- risk  
23 insights and the issue resolution process. As we've  
24 discussed with you in the past, the NRC has used risk  
25 insights in preparation for issue resolution meetings,

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1 the round one meetings, as I've been calling them. As  
2 we move forward into the next round with DOE, DOE has  
3 been looking at these agreements, I'm pretty sure,  
4 from a risk point. And using Bret's initiative and  
5 some of the information we'll get out of that, we can  
6 go into those meetings and really focus on the  
7 agreements and see just to make sure we're asking the  
8 appropriate RAIs, as Wes called them.

9 And the last bullet, future issue  
10 resolution meetings will also use risk insights, and  
11 the point I was trying to get there is, basically that  
12 the bottom bullet, is that based on the discussions of  
13 risk some of the agreements may change in scope or  
14 possibly could be deleted all together if a DOE  
15 strategy is changed or things like that.

16 MR. LARKINS: Would that also mean that  
17 you may recategorize the agreements?

18 MR. ANDERSON: Categorize the subissues?

19 MR. LARKINS: Yes.

20 MR. ANDERSON: It could.

21 MR. LARKINS: Not the agreement, the  
22 agreements. Rather than having what you call 293  
23 agreements, have them recategorized.

24 MR. ANDERSON: You mean have less or --  
25 I'm not sure what --

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1 MR. LARKINS: Combined group package.

2 MR. ANDERSON: Yes. I mean, basically,  
3 what -- I'm trying to think what we'd do in situations  
4 like that. We've used a number of different things.  
5 We could just say agreements complete superseded by  
6 another agreement. We could do that way or in some  
7 instances we've actually modified the wording of the  
8 agreement to be more specific. I'm not sure if I'm  
9 answering your question, though.

10 MR. LARKINS: I was going back to this  
11 communication issue that John had raised earlier, if  
12 there was a better way of categorizing the 293  
13 agreements into something that was more readily  
14 understood and less misunderstood.

15 MR. ANDERSON: I don't think we have any  
16 effort at this point to do that.

17 CHAIRMAN HORNBERGER: I think you can take  
18 that as a comment and just go on.

19 MR. ANDERSON: At that, I will. Moving  
20 on, just a quick status of where we're at with the  
21 integrated issue resolution status report. This has  
22 been a work in progress for quite a while, and it will  
23 document the status of issue resolution. It will  
24 follow the Yucca Mountain review plan format, and we  
25 expect to issue it sometime hopefully in the next few

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1 months, spring of 2002, which is on the slide there.

2 The first version will discuss the KTIs  
3 preclosure and quality assurance areas, and then  
4 future revisions will discuss remaining areas within  
5 the Yucca Mountain review plan. As the last  
6 presentation in preclosure, there's a couple areas  
7 where -- in the preclosure area where DOE hasn't given  
8 us any information, so they won't be addressed in this  
9 first version, but hopefully we can include that type  
10 of information in future revisions.

11 In summary, we believe the issue  
12 resolution process is progressing. The NRC staff is  
13 actively monitoring the agreements, and like I  
14 mentioned earlier, we're in the process of getting out  
15 several reviews of agreements that DOE has already  
16 provided information for. We're anxiously awaiting  
17 DOE's plan to see how they're going to go from fiscal  
18 year '02 to LA, and I think that will help both -- I'm  
19 sure it will help DOE, and it will also help NRC in  
20 our planning for products and how we want to handle  
21 meetings in the future. NRC staff will continue to  
22 refine the use of risk insights, and the next round of  
23 technical exchanges will further refine information  
24 gaps, which I've briefly discussed.

25 So I guess with that -- I guess I didn't

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1 point out during my presentation, I mentioned the  
2 subissue table in the backup documents. There's also  
3 another table which outlines all the agreements, and  
4 the slide before that has the five categories I used  
5 to status the agreements. So that last table is  
6 hopefully to capture the status of all the agreements  
7 in one spot. So with that, if there's any questions  
8 I can try to address or I can hand off to someone  
9 else.

10 CHAIRMAN HORNBERGER: Thanks very much,  
11 James. John?

12 MEMBER GARRICK: Jim. I attended one of  
13 the technical exchange sessions and was reasonably  
14 impressed with the efficiency with which it was  
15 conducted, considering the size of the group that was  
16 there and the somewhat formal process. You indicated  
17 that you're having a meeting to kind of decide what  
18 might be described as how to do the next round.

19 Do you anticipate any fundamental changes?  
20 What kind of lessons have you learned? Do you find  
21 that the system from the point of view of NRC staff is  
22 working well? Or if there are problems, what are  
23 those problems? What do you see as the major  
24 difference between the second round and the first  
25 round in terms of the process?

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1 MR. ANDERSON: The process, at least the  
2 way I envision it, and, again, that's one of the  
3 reasons for the meeting in February with DOE just to  
4 make sure we're all together on it, the way I envision  
5 it is we'd focus to the most extent on the agreements  
6 themselves and any new information that comes up. I  
7 think to try to just keep refining what the  
8 information gaps are, any additional information  
9 letters we've sent out to discuss those, just to make  
10 sure that DOE understands what the NRC's asking for  
11 and that the NRC understands where DOE's going, just  
12 to continue to refine that process.

13 One of the aspects of the first round of  
14 meetings that I think we will definitely need to  
15 continue is the number of pre-call or preparation type  
16 phone calls with DOE just so we're all clear on what  
17 we're going to try to discuss during these meetings.  
18 I think that was the key all the preparation for those  
19 phone calls and the phone calls themselves I think  
20 really helped focus both the NRC and DOE staffs to  
21 really have a productive meeting, especially when we  
22 have that many people involved in the broad areas.

23 MEMBER GARRICK: Since these are open  
24 meetings to the public, do you anticipate any change  
25 in terms of how the public participates in the

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1 process?

2 MR. ANDERSON: I think we'll try to  
3 continue some of the things we did toward the end of  
4 the first round of meetings, basically presenting kind  
5 of an overview of the technical area we're going to  
6 discuss to help the public understand the issues that  
7 are going to be discussed during that meeting. We  
8 will continue addressing questions the public has  
9 during breaks or at different parts of the meetings we  
10 open it up for public questions and participation.  
11 Besides that I don't -- nothing comes to the top of my  
12 head, but --

13 MR. AHN: Yes. This is Tae Ahn. During  
14 our follow-ups of DOE's implementation of the  
15 agreement, we learned that their official document  
16 lacks many details of their accomplishment. In other  
17 words, they could have closed certain agreements by  
18 laying out properly, but they didn't do. We know they  
19 implemented those aspects, but in the documents they  
20 just simply did not write all of them. So in the  
21 coming meeting, with face-to-face meeting, we'd like  
22 to make sure they did they, they implement the  
23 agreement. That may be an example of new things, at  
24 least in our set of KTIs.

25 MEMBER GARRICK: Thank you.

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1 CHAIRMAN HORNBERGER: Milt?

2 MEMBER LEVENSON: Yes. One question, Jim,  
3 which is kind of a maybe rewording that's been asked  
4 twice before, and I assume maybe you'll -- in the 293,  
5 if you were to make a guess as to are any of them, and  
6 if so how many, potentially road blocks, have the  
7 potential to say, "We're in big trouble"?

8 MR. ANDERSON: You know, I would have to  
9 give those questions to the KTI leads, because I'm not  
10 technically smart enough to know -- I'm a process  
11 person.

12 MEMBER LEVENSON: Well, you're the only  
13 person I know that's heard all the KTI discussions, so  
14 I just wondered whether you'd heard people say, "Oh,  
15 boy, that's going to be a tough one," or whether you  
16 have a -- are there any potentially that are real road  
17 show stoppers, so to speak, do we know? I mean just  
18 a feeling. I can't ask you to project the future  
19 because --

20 MR. ANDERSON: I mean I would have to go  
21 back again to the chart that Bret provided and which  
22 categories are major efforts on DOE's part.

23 MEMBER LEVENSON: Well, maybe a major  
24 effort. That's not really the question. A major  
25 effort implies that if they put some people on it,

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1 they can do it. That's not necessarily a show  
2 stopper.

3 MR. LESLIE: Yes. And I think what you've  
4 got now is if we felt that there was a road block,  
5 then a subissue would have been open.

6 MEMBER LEVENSON: Right.

7 MR. LESLIE: Okay. If you look at how  
8 issue resolution is defined, basically you come to  
9 that conclusion. We've come to the conclusion that  
10 are subissues are closed-pending, which we've outlined  
11 what the gap is, DOE has agreed to provide that  
12 information, and we believe that they will provide  
13 that information.

14 MEMBER LEVENSON: If I put some words in  
15 your mouth, would you say then that as of now you  
16 don't -- you can't identify any among the 293 that are  
17 potentially show stoppers? Okay.

18 MEMBER GARRICK: The record doesn't deal  
19 with nods.

20 (Laughter.)

21 MR. LESLIE: I was only imitating my boss.

22 (Laughter.)

23 MEMBER GARRICK: And that was a vertical  
24 nod, John.

25 (Laughter.)

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1 CHAIRMAN HORNBERGER: Any other questions?  
2 Latif?

3 MR. HAMDAN: Yes. I think I want to make  
4 one comment that will clarify to Dr. Garrick and,  
5 Milt, also question. The way to think, and this will  
6 follow-up maybe on what Milt said. In other NRC  
7 programs, we do what's called acceptance reviews, and  
8 these reviews are done after a license application or  
9 license application is received for the sole purpose  
10 of determining whether or not the licensee has  
11 submitted a complete application, complete enough to  
12 conduct an objective review. In this case, if you  
13 think of this as an acceptance review, then before the  
14 license application in the pre-license space, this  
15 will clarify a lot of things. You will not find road  
16 blocks. All that's being done now is saying, yes, if  
17 you honor these agreements, if you give us these RAIs,  
18 then hopefully by the time the license application we  
19 will have a complete application, we will accept the  
20 application and start the review.

21 MEMBER GARRICK: Yes, we appreciate that,  
22 and what you're really saying is that we have to keep  
23 reminding ourselves that what we're talking about here  
24 is what constitutes a sufficient amount of information  
25 to be a reasonable license application.

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1 MR. HAMDAN: So when you take --

2 MEMBER GARRICK: We're not offering a  
3 license.

4 MR. HAMDAN: Yes. So the road block, if  
5 they come, and hopefully they will never, if they are  
6 ever going to come, they will come after --

7 CHAIRMAN HORNBERGER: Having said all  
8 that, and we do appreciate that, and you know the  
9 sense of the reason that we're questioning. But  
10 having said that, we do have not just suspicions but  
11 pretty well-founded arguments that all 293 are not  
12 equal, right? And what we were simply looking for was  
13 some accounting of which ones are the ones that will  
14 require a major investment of person hours by DOE? So  
15 that was the nature of our question had two aspects.  
16 But we appreciate that.

17 Thanks very much, James. I wanted to ask  
18 April Gill if there was anything that I had said that  
19 she wanted to correct or if she wanted to comment on  
20 anything that has been said. Anyone from DOE?

21 MEMBER GARRICK: Well, we just got an  
22 offer. They might be willing to make a few comments  
23 that offer a little perspective to this. I think we  
24 ought to take them up on it.

25 CHAIRMAN HORNBERGER: Please.

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1 MR. WILLIAMS: Dennis Williams, DOE.  
2 There's a lot of ways to bin up 293 agreements, and of  
3 course we've done -- am I coming across okay? And  
4 we've done quite a bit of work on that, because we've  
5 had quite a bit of discussion on what these 293  
6 agreements entail. And I do have one work-up here  
7 that has some categories and it has the number of  
8 agreements and percentages in those particular  
9 categories. One is perform testing with the  
10 associated analysis. There's 11 agreements that speak  
11 to that. There's one category that says basically  
12 just perform some analysis. There's 41 agreements  
13 that speak to that. There's a category that says  
14 provide additional technical bases or documentation.  
15 There's 188 in that particular category; that's 64  
16 percent.

17 And in that category, some of those are  
18 where we provided what we thought was appropriate, but  
19 a lot of it was based on judgment, a lot of it was  
20 based on -- I'll put it this way: Whenever some of  
21 our technical people write a report, as all technical  
22 people do, they understand it very well. But  
23 oftentimes it doesn't come across very well to the  
24 reader or understandable. So that's the traceability  
25 issue, the transparency issue, and a lot of that is in

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1 the category of documentation. And many times we have  
2 an agreement that says, "Provide a technical basis or  
3 the DOE provide a technical basis or basically other  
4 evidence on how you are proceeding with regard to an  
5 agreement."

6 Procedures or guides that are provided,  
7 six. Provide a test or study documentation. These  
8 are tests or study plans; 24. Provide existing data  
9 and databases, databases that already exist but  
10 weren't available; 13 in that category. And then  
11 there's a miscellaneous category of about ten, and  
12 that should add up to the 273.

13 MEMBER GARRICK: One number I missed, the  
14 one that was the third one you gave, the additional  
15 technical basis and documentation.

16 MR. WILLIAMS: Hundred and eighty-eight.

17 MEMBER GARRICK: Okay.

18 MR. WILLIAMS: Which constitutes 64  
19 percent.

20 MEMBER GARRICK: Okay. So that --

21 MR. WILLIAMS: And I can give you, you  
22 know, these --

23 MEMBER GARRICK: These others are the subs  
24 of that.

25 MR. WILLIAMS: Right. Right, the numbers

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1 after that. When we went into these technical  
2 exchanges and we started deciding what DOE would or  
3 could do, in the beginning it was, to a large extent,  
4 fairly simple, because most of this work was already  
5 in our plan. So it was just a matter of pulling it  
6 out of the plan, communicating with the Nuclear  
7 Regulatory Commission and then deciding on when we  
8 would do it. When we would do it has become more of  
9 the difficulty a lot of times than actually what needs  
10 to be done, because I think there's a lot of agreement  
11 on what needs to be done, because we have a technical  
12 staff, they have a technical staff. They're pretty  
13 close on the needs. So most of it was sorting out  
14 when we would actually get the work done.

15 As far as addressing the potholes, I think  
16 there are some potholes out there that will slow  
17 things down a little bit. Are there any tar pits that  
18 we will become embroiled in that we will never get out  
19 of? I don't think so. I think that one of the terms  
20 is, "this isn't rocket science." I mean most of these  
21 things can be worked out. Some take a little bit more  
22 time than others.

23 We have a pretty good idea that we can  
24 work out these things, because we've ran the plans  
25 out, we've ran the scopes out. We have a pretty good

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1 idea of what scope we need to have to satisfy these  
2 agreements. The only problem is it extends out for  
3 quite a period of time, and now we're in the process  
4 of figuring out how do we refine that, how do we run  
5 some things in parallel, how do we make it come in a  
6 little bit sooner?

7 The areas that are the potholes, in my  
8 estimation, they're areas where we hadn't done a whole  
9 lot of work on, like container life and source term.  
10 We've delayed that a lot over the years. Probably the  
11 other area that's going to take a lot of effort to get  
12 it sorted out is igneous activity. Not that we didn't  
13 know about a lot of these things. Our technical  
14 people had noted that some of these things needed to  
15 be done depending a lot on what kind of a design we  
16 had.

17 And as we pulled back out of the design,  
18 some of these things became more important. Igneous  
19 activity, we've got a plan that our people have put  
20 together. It's a two- to three-year program. There's  
21 several million dollars involved in it, but it can be  
22 done. Again, there's nothing there that is really,  
23 really difficult. Biggest issues are associated with  
24 when we can get it done based on the resources that we  
25 can apply.

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1 CHAIRMAN HORNBERGER: Good. Thank you.

2 MR. LARKINS: Can I ask a quick question?

3 CHAIRMAN HORNBERGER: Yes. Go ahead.

4 MR. LARKINS: Are you prioritizing these  
5 now, going back, looking and establishing some  
6 priority for these?

7 MR. WILLIAMS: We don't specifically  
8 prioritize the KTIs or prioritize the agreements.  
9 What is more, I think, important is doing -- certain  
10 things you have to do first before -- okay, in some  
11 cases, you have to do some testing before you can do  
12 the analysis of it, before you can move it into the  
13 abstractions and into the models. So I think we're  
14 more concerned about that kind of a sequence than  
15 specifically prioritizing one as being more important  
16 than the other.

17 One other thing I just thought of, and  
18 that has to do with whether or not we had agreed to  
19 something that couldn't be done. And one case I  
20 remember specifically, and that had to do with  
21 drilling our undisturbed samples from the alluvium,  
22 drilling to get undisturbed samples from alluvium.  
23 And in my mind, that was in impossible task, because  
24 I've tried to do that several times over the past 30  
25 years. It just doesn't work out. We had a lot of

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1 debate about that.

2 In the end, we agreed that it couldn't be  
3 done, we would figure out a different way of doing it.  
4 So based on that and some other discussions that we  
5 had during the sessions, I don't think that we've  
6 described anything that cannot be done.

7 CHAIRMAN HORNBERGER: Thanks very much.  
8 Thanks, James. I didn't mean to keep you standing  
9 there all that time.

10 MR. ANDERSON: No problem.

11 CHAIRMAN HORNBERGER: Okay. Well, I think  
12 we are pretty much on time. That's quite amazing  
13 after a full day, a very full day. I want to thank  
14 not only all of the presenters but all of the people  
15 who contributed to the material being presented, and  
16 I know it was a lot of people. I know this was done  
17 in a big hurry. I appreciate that you said that you  
18 utilized some information that you had available prior  
19 to it.

20 Nevertheless, this was a big investment of  
21 time and effort, and certainly the ACNW and our staff  
22 really appreciate the effort that people went to to do  
23 this. It's been very good for us to get this update,  
24 and after we have some discussion we may in fact get  
25 back to you with any points that we need clarified.

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1                   With that, I think what I am going to do  
2                   is thank you for all of the Center people too down  
3                   there at the Center. Yes, I included the Center in my  
4                   thanks. I'm going to call a five-minute break. We  
5                   will end the recorded portion of the meeting. I ask  
6                   the members to come back in five minutes. There are  
7                   some things that we need to discuss, and potentially  
8                   make some headway on our research report. Five-minute  
9                   break.

10                   (Whereupon, at 5:05 p.m., the recorded  
11                   portion of the ACNW Meeting was concluded.)  
12  
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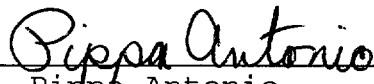
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Pippa Antonio  
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