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

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

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

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

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

Are there any requirements -- do any of

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

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

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

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

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

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

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

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

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

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

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

CHAIRMAN HORNBERGER: Right. Thank you.

MR. CRAGNOLINO: I'm sorry, for the source term, you know -- you are aware of that?

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

MR. HAMDAN: Gustavo, since you --

CHAIRMAN HORNBERGER: Use the microphone.

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

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

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

MR. CRAGNOLINO: Yes.

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

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

At the time of the license application, and I don't know when it is going to be, but let's assume that the license application is going to be 2 years down the road, or 3 years down the road.

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

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

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

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

MR. CRAGNOLINO: But to put it in --

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

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

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

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

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

CHAIRMAN HORNBERGER: Okay. Really short.

MR. HAMDAN: Very short. This question

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

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

CHAIRMAN HORNBERGER: Tae Ahn.

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

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

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

(Whereupon, at 12:15 p.m., a luncheon recess was taken.)

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.

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

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

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

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

And the third one, which is mostly what I am going to talk about, is that they need to provide the additional information related to what was agreed to in the recent technical exchanges.

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

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

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

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

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

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

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

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

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

And some of that is related to the Nye County wells, some of which are still being drilled. We have asked them to look at some alternative conceptual models for flow, and there is also an update to the regional flow model for the Death Valley ground water basin.

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

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

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

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

A lot of the agreements are related to

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

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

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

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

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

CHAIRMAN HORNBERGER: Jim, have they

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

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

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

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

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

So where it has gone from there is the test plans for that ECRB were extended, and significantly enhanced, and cameras were installed, and sensors were installed, and air flow monitors were installed, and humidity monitors, and the period for the test now to my knowledge is specified as indefinite basically until they find the answers to the questions.

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

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

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

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

MR. WINTERLE: I don't think so.

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

MR. WINTERLE: Yes, this one has a double-bolt cut head over a large portion of it, and so I am sure that there is some escape through the cracks around the bulk head, but they have done a good job to minimize that.

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

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

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

And interact with DOE as we have been doing over the past few years to make sure that they understand what our underlying concerns are. In 2001, some of our accomplishments were -- well, I guess I will start with the first bullet.

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

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

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

And that will be in integration with the structural defamation and seismicity KTI. A lot of that work. And we are going to do some of our own independent -- document some of our own independent modeling, and review DOE field studies in a report to NRC.

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

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

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

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

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

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

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

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

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

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

I guess that relates to Bret's table here.

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

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

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

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

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

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

Yet it doesn't seem important for the

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

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

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

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

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

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

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

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

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

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

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

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

CHAIRMAN HORNBERGER: John.

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

DOE field studies?

MR. WINTERLE: The scope and schedule?

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

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

MEMBER GARRICK: It is part of the agreement.

MR. WINTERLE: The PTI agreements.

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

CHAIRMAN HORNBERGER: This is being piped directly to --

(Laughter.)

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

Early indications with -- there is one

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

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

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

MEMBER GARRICK: Thank you.

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

MEMBER LEVENSON: Things are heating up.

CHAIRMAN HORNBERGER:

(Brief Pause.)

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

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

And Jeff Pohle and Asas Chowdhury, too,

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

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

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

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

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

(Laughter.)

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

The first one is losses through the drift scale thermal test bulkhead. There was a question that started to allude to that topic, and the notion that they put heaters into a drift to mimic canisters, and then realized after they had been going for a while that there was quite a bit of heat loss out, and quite a bit of water loss out.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

MEMBER GARRICK: I was just curious if you had developed some interesting and ingenious approach to that problem. Proceed.

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

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

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

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

We did not specify where it is going to be documented, but here is the essence of what we were looking for. There is one technical agreement waiting for a DOE response, and that has to do with the drift scale heater test. There was a white paper on that prepared by the Department of Energy.

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

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

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

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

It is a case where it is not only where they are expanding the repository domain and there is a characterization issue, but there is also maybe the cold trap effect that is going to become even more important for that operating mode.

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

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

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

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

I think it will end up being a combination of here is what is reasonable to do, and we will justify what we don't include, and we will expand uncertainty and account for things, and I will leave that one alone.

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

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

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

And some of those observations I would be referring to are when water starts -- the possibility of water going down fractures and through the dry out zone, the fingering, the reflux approach.

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

MR. FEDORS: No.

CHAIRMAN HORNBERGER: Okay.

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

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

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

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

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

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

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

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

What does the NRC need to do before LA? Well, you have probably seen a few of these same things here. I might just summarize them as a little bit of our job is to kind of anticipate what we are going to run into down the line, and that the meetings that we have with the Department of Energy certainly facilitate us being a little bit more up to speed on things, rather than waiting for a document to come out sometime later.

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

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

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

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

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

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

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

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

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

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

Work plan for Fiscal Year 2002. I will

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

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

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

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

CHAIRMAN HORNBERGER: John.

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

CHAIRMAN HORNBERGER: Okay. Raymond.

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

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

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

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

MR. FEDORS: That is something that I have not sorted out entirely, and I thought there was some confusion because some discussion of ventilation, natural ventilation, so they would leave the drifts open to take advantage of any -- you know, they have got the infrastructure down there and there might be additional ventilation over and above an ambient ventilation through the mountain that would help them out.

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

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

CHAIRMAN HORNBERGER: Milt.

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

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

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

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

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

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

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

MEMBER LEVENSON: Yes, but it's much more complex than just how water flows through fractures in that if you have a hot repository for a few hundred years, you're going to be having evaporation in the pores. If you have a cold repository, presumably you have almost none. Are those effects part of what you're looking at when you talk about thermal effects on flow? If you're evaporating water for 500 years, is there any porosity left when it finally cools down, et cetera? It seems to me there are some major issues.

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

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

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

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

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

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

MR. LESLIE: It's covered.

MEMBER LEVENSON: Okay.

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

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

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

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

MR. POHLE: Yes. This is Jeff Pohle, NRC staff. It's basically a paragraph within the letter that covers a number of KTIs coming out to Jim Anderson. Basically, what we do in that paragraph is tie it into a number of items the Department said they were going to do. At the technical exchange, we got this thick handout, so we called out of there, "This is what you said you're going to do, and we think if you're doing this way to this agreement, that agreement, that agreement, this ensemble, if you did this, would be the path forward to resolve this particular item." I don't know the numbers well right now.

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

CHAIRMAN HORNBERGER: Okay. But it's --

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

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

MR. FEDORS: Yes.

CHAIRMAN HORNBERGER: Okay.

MEMBER LEVENSON: George, I have a question.

CHAIRMAN HORNBERGER: Sure.

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

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

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

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

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

MR. FEDORS: Yes.

MEMBER LEVENSON: -- and a number of other phenomena, and it was very extensive.

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

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

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

MEMBER LEVENSON: That's project confirmation.

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

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

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

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

We have several agreements. I'll discuss them in detail in the following slides. Essentially, they're focused on getting information that we need to be comfortable about the processes used to model and represent radionuclide transport.

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

Just specifically, one of the most important agreements that we have is kind of a very generic one and that is provide analysis and documentation of transport parameters. Essentially, a lot of the values used for KDs throughout the transport models in the system were based on expert judgment, so the particular values are derived from a very limited group of experts who kind of made estimates on what those KD values should be. Yet there's not a specific set of documents that provide traceability and justification for those values. And so what we've asked, and DOE's agreed to, provide that information to us.

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

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

CHAIRMAN HORNBERGER: Paul?

MR. BERTETTI: Yes, sir.

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

MR. BERTETTI: Correct.

CHAIRMAN HORNBERGER: You mean --

MR. BERTETTI: Protactinium.

CHAIRMAN HORNBERGER: Yes. So protactinium is an issue?

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

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

MR. BERTETTI: Well, we really don't know unless we have some sort of information to gauge that. Well, I mean that's part of the problem is we can make a lot -- radionuclide transport is an interesting issue, because a great many people think they know a whole lot about it in the sense of, "Well, we can model this using a KD." And the problem is there aren't too many real examples of where a KD model has been successful at predicting that actually has happened. And so what we'd like to do is get some information so we can check off the box. And I would agree with you for the unsaturated zone in this sort of transport, you're probably correct.

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

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

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

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

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

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

I have a bullet on for colloids so I'll mention them. Whether or not colloids are very important to dose or very important to the performance of the system is of some question; however, there's field evidence that colloids may have been transported at the Nevada Test Site, DOE has incorporated colloid modeling in their TSPA model, we are going to incorporate it in the next revision of the TPA code to help us evaluate the importance of that. So what we're asking for is a sensitivity analysis to kind of test the importance of the parameters used to develop that colloid model.

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

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

While this slide is not particularly useful for this meeting, but it does -- the importance here is that we spent a significant effort, like I mentioned earlier, trying to understand the risk significance and the documentation that DOE had provided before our technical exchange. We were kind of like the middle of the line, essentially, so we spent a particular amount of effort to try to get things as risk informed as possible.

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

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

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

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

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

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

Okay. So here are some examples of information that we can gather from our own analysis and collection of materials. This, for instance, is a sample of alluvium collected from one of the Early Warning Drilling Project wells, showing that there's maybe some fine-grain codings on some of these grains. And some recent studies have indicated that maybe with these kind of codings they actually drive the sorption drive process, and they might be actually fairly generic and that they actually may be very much like clay. And it turns out that recent DOE results also indicate that the sorption of alluvium is kind of driven by the presence of clay above maybe anything else. And you can also start to group well water chemistries, not only with respect to depth in the saturated zone but spatially as well. So that's some important things that we can do, and then we can be prepared for the next step of characterization and modeling.

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

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

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

MR. BERTETTI: Yes, sir. So here's an example of the experimental results for neptunium uptake on calcite. This is just the distribution coefficient, or KD, for neptunium and plotted against the pH or the solution. What I don't want to say is neptunium sorption on calcite is not necessarily the most important aspect of transport in the alluvium, but what's important about this is that DOE assumptions of transport of the alluvium for the TSPA VA were based on these limited results with water from UE25-p#1, which is that deep carbonate aquifer well. And, in fact, the processes that control this sorption and the magnitude of sorption are not really related to the process controlling sorption in the alluvium. In fact, now DOE has conducted some data with alluvium samples, but we're still limited to a very narrow range of pH. And so I think we have to be careful about potential invalid assumptions regarding mechanism and the magnitude of sorption.

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

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

MR. BERTETTI: Variations in what respect?

MEMBER GARRICK: Well --

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

MEMBER GARRICK: Okay.

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

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

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

MEMBER GARRICK: Yes.

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

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

MR. BERTETTI: Well, you know, I'd like to do that. I mean to me that's -- the redox state of the system is very important, and that goes to the characterization. Some people might make an argument that specific mineral surfaces might provide a micro redox environment that really would enhance sorption. The problem is if you have four wells over ten kilometers, to try to characterize that, you're not going to be able to make a defensible argument to support that.

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

MEMBER LEVENSON: Before you take that off --

MR. BERTETTI: Yes, sir.

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

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

(Laughter.)

MEMBER LEVENSON: Well, the question is

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

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

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

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

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

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

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

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

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

CHAIRMAN HORNBERGER: Thank you, Paul. Milt?

MEMBER LEVENSON: I asked them along the way.

CHAIRMAN HORNBERGER: Raymond?

VICE CHAIRMAN WYMER: I had a couple, Paul.

MR. BERTETTI: Yes, sir.

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

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

VICE CHAIRMAN WYMER: Then you said that DOE's going to tell you how they got their results. Does that mean they're going to tell you how they ran their expert elicitation or does that mean they're going to go out and get more results?

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

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

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

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

MR. BERTETTI: That may be correct.

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

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

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

(Laughter.)

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

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

VICE CHAIRMAN WYMER: And, finally, with

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

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

VICE CHAIRMAN WYMER: Right.

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

MR. BRADBURY: Yes, this is John Bradbury, NRC. With regard to your questions concerning expert judgment, first of all, it was our -- DOE and their labs have collected a lot of sorption data for man years. I was our understanding that the use of the expert judgment was mainly with regard to establishing distributions to be applied in performance assessment, and so we were looking for the explanation concerning how the distributions were --

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

CHAIRMAN HORNBERGER: Probability.

VICE CHAIRMAN WYMER: Probability distribution.

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

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

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

MR. BERTETTI: I would agree with that, and I'd also temper that, that there are some nuclides that are not -- weren't well studied. I mean there's a little bit of minor nuclides that may not be important that didn't have a lot of experimental basis behind them.

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

CHAIRMAN HORNBERGER: John?

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

MR. BERTETTI: DOE has mentioned that as well. DOE had a suggestion that the radionuclide transport KTI would be rolled into one large KTI that would essentially be called flow and transport, primarily because that's how they have organized their system. I think it's important -- why is it a KTI? I think there a lot of aspects of radionuclide transport that take a lot of resources to address the --

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

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

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

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

MEMBER GARRICK: Right.

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

MEMBER GARRICK: Yes. He did say that.

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

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

VICE CHAIRMAN WYMER: The implication is that even if you have a coupled effect and you produce something different from what you're going to find in the far field, that like a valence change, that that will then occur as you move away from the near-field, that you'll get back to the species that you're looking at. That's the implication of what you're saying, I believe.

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

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

And I think there's a similarity here, even though the mediums are very different, and I even know in WIPP that there was a tremendous amount of effort, especially late in the program, in trying to define the source term. And I suspect we're going to hear about that when we hear about the near-field work, but I do see a real disconnect in what we've heard this afternoon with respect to radionuclide transport.

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

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

CHAIRMAN HORNBERGER: Just to make sure that I'm clear on this, I want to make sure that it's not a disconnect in a bad sense. I mean John is saying it's a disconnect, but it's only a true disconnect if in fact you're working off on the source term here and you're working on radionuclide transport completely independently of that, and I don't think that's what you're doing, is it?

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

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

So it's something that needs to be evaluated as we learn more about how the near-field chemistry responds, and right now that's one of the large areas of uncertainty is what's happening in the waste package in and around the waste package chemistry? And I don't want to step on what Bobby might say, but that's a high degree of uncertainty. And so until we get a better handle on what that chemistry is and how that responds as we have some infiltration, then I think it's very tough to couple anything.

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

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

CHAIRMAN HORNBERGER: Okay. Milt?

MEMBER LEVENSON: I think, George, to some extent, all of the KTIs are really independent. You take the pieces and that's what the modeling and the code -- just like the corrosion didn't discuss that it's probably irrelevant if there's no water, from the standpoint each KTI, to some extent, is completely independent. They have to depend on the other operations to put them together.

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

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

(Laughter.)

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

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

(Laughter.)

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

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

Now, we wanted to show what DOE needs to provide before license application. Well, the most important thing is they need to decide on the repository design and the thermal operating mode. As we all know, the materials -- the repository design, the materials that go into the repository and the temperature conditions under which these materials are exposed to are the main drivers for the coupled THC processes.

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

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

The DOE also needs to provide additional information as a result of the agreements we had at the technical exchange. There are 41 agreements as a result of the technical exchange. That's a long laundry list. Fourteen of those have been received, and we expect to receive 27 sometime in this fiscal year. Although it's a long list, many of them are relatively straightforward. For example, it ranges from providing sufficient technical basis for some of the FEPs that have been excluded from the abstraction all the way to more complex requirements dealing with data uncertainty, model uncertainty and model validation.

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

I'm going to give just a few examples of the more important agreements for each of the subissues. For Subissue 1, which pertains to the coupled THC processes on drift seepage and flow, the DOE needs to address the various sources of model and data uncertainty in its THC abstraction. One of the agreements that we came to at the tech exchange was that DOE needs to provide physical evidence that supports the model of matrix/fracture interactions, specifically the facts on precipitation processes. The DOE is supposed to provide data on the post-test overcoring. I believe this pertains to the single heater test. And also they need to provide the results of ongoing sidewall sampling for the drift scale heater test. Some of the information I believe has been provided. Most of these results are still to be expected for this fiscal year 2002.

For Subissue 2, which pertains to the waste package and drip shield chemical environment, Gustavo pointed out of the need for the DOE to provide a good handle on the quantity and the chemistry of water contacting the drip shield and the waste package. Because the chemistry and the quantity determines the performance of the drip shield and the waste package materials. As you all know, the performance of the waste package and drip shield is a key safety attribute of the DOE safety case. The DOE needs to place bounds on the concentrations of the minor and trace elements which are important to performance, for example, fluoride in the case of the titanium alloy drip shield. The DOE needs to evaluate the effects of evaporation or salt deposition or the interaction with engineered materials on the chemistry of the water contacting the drip shield and the waste package surfaces.

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

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

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

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

For Subissue 5, on the potential criticality in the near-field, all they need to do is they need to close the open items remaining in the NRC safety evaluation report with respect to the disposal criticality analysis methodology topical report. And they also need to revise the FEPs screening arguments concerning criticality. So those are fairly straightforward.

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

For FY 2001, we have basically spent most of our time conducting an intensive and critical review of DOE documents related to a near-field -- various reports, technical basis documents, SER, SSPA and AMRs and PMRs. We conveyed -- we contributed to NRC reviews of these documents and helped convey NRC concerns to the DOE staff in various technical exchanges and in numerous pre-tech exchange teleconferences, and also in addition to the teleconference and sufficiency review. We helped identify risk-formed paths through resolution of NRC concerns, resulting in the status of the first four ENFE subissues being changed from open to closed-pending. We also documented our review and the status of subissue resolution in the integrated IRSR report that's going to come out sometime this year.

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

In addition to the MULTIFLO work, we conducted focused application of process-level models to test DOE hypotheses pertaining to the deliquescence points of salt mixtures that can deposit on the drip shield and waste package surfaces. We also looked at the chemical evolution of our Yucca Mountain groundwaters that can result due to evaporation. We also conducted focused experimental studies to study deliquescence points of mixed salt systems, as well as studies relating to uranophane solubility.

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

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

The next two viewgraphs basically show the results of those process modeling work. This particular study was designed to test the DOE hypothesis. The DOE, in its abstraction of the chemistry of water on the waste package and drip shield surface, assumed that aqueous corrosion begins when the relative humidity reaches the deliquescence relative humidity of pure salt. In the TSPA-SR report, they assumed -- they used the sodium nitrate deliquescence humidity as a lower bound for the deliquescence point of salts that could form in the waste package drip shield surface.

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

Basically, the bottom line of the calculations suggest that, okay, if you have sodium chloride plus potassium chloride mixture, then it's okay to use a pure sodium nitrate deliquescence humidity as your bounding point for the deliquescence point of the mixture. On the other hand, if you have a magnesium chloride mixture with NaCL or KCL, and also in essence with calcium chloride, which is another salt that has very low deliquescence humidity, then it's not appropriate to use a pure sodium nitrate salt as a lower bound for the deliquescence part because of the salt mixture.

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

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

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

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

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

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

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

For FY 2002, our plan is basically to review the DOE documents relevant to near-field subissues. We will continue those process-level modeling work that may have been conducted. Those are supported by some experimental studies because there's really no experimental data on the deliquescence point of salt mixtures at elevated temperatures. I have a backup slide, I believe Number 2, that demonstrates some of those results. We will continue to develop MULTIFLO version 2 with enhanced capability to simulate coupled THC processes. MULTIFLO will be used to predict the quantity and chemistry of seepage water and to help quantify uncertainties associated at the process level and PA simulations for complex coupled processes. We plan to validate these process-level models that we have used in reviewing the DOE analysis, and we will provide input to the integrated IRSR rev 1.

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

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

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

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

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

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

VICE CHAIRMAN WYMER: Okay. The second question I had is I was -- just kind of an observation. I was a little bit surprised to hear you say that you thought that the calcium nitrate ion pairs are sufficiently strong that they would significantly reduce the nitrate ion -- free nitrate ion concentration.

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

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

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

CHAIRMAN HORNBERGER: Milt?

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

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

MR. LESLIE: This is Bret Leslie from the staff. If Bobby moves a little bit that way, it's important to remember that when we developed our sufficiency comments, we took -- we may have five KTIs reviewing the same AMR, and they're reviewing it under their KTI, but we're providing integrated comments. So the answer to your question is, no, the mechanical things aren't necessarily reviewed by the near-field, but they're either reviewed by the container life and source term or the repository design and thermal mechanical effects.

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

MR. LESLIE: That's correct.

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

MR. PABALAN: Subissue I pertaining to

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

MEMBER LEVENSON: Somewhere else.

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

CHAIRMAN HORNBERGER: John?

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

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

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

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

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

MR. PABALAN: Yes.

MEMBER GARRICK: Yes. Okay.

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

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

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

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

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

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

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

The properties of ground support, the only issue here is that -- the only concern, I should say, is that DOE wants to exclude corrosion of ground support -- possible corrosion of ground support material during the pre-closure period. And the argument for that is that we don't want that to cause cooling corrosion or obvious corrosion. All they need to consider is dry air oxidation and to get rid of that is very slow for -- and will not cause appreciable corrosion for 300 years.

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

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

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

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

Then the DOE intends to use rock mechanics analysis to demonstrate that the -- all the ground openings will be stable through the pre-closure period to support the pre-closure and all the things that are required. And that is, again, a good approach. It could be supplemented with a maintenance plan, but that hasn't been discussed.

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

On post-closure, the first is rockfall and drift collapse. Not included in performance assessment, the point is cleaned out using a combination of design and probability. For rockfall, DOE wants to design -- DOE wants to select a design basis rock impact and design the drip shields and waste packages to withstand such rock impact, and then argue that the probability of larger impacts will -- what's happening? I thought you could hear me.

PARTICIPANT: You didn't turn it on.

MR. OFOEGBU: Oh.

PARTICIPANT: You've been talking very load.

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

(Laughter.)

Okay. So they want to design the drip shield and waste package to withstand the design basis rock impact and then argue that larger impacts -- the probability of larger impacts is below the regulatory limit. And we believe that this approach is valid. There are a number of things, the way that they define the design basis rock impact, both the size and frequency. We had problems with that. We had problem with how they conduct analysis to demonstrate a drip shield and waste packages will withstand impact. We also have problem with the probability of larger impacts. But the approach that DOE has selected should lead to a resolution of these if things are carried out satisfactorily. And there is no reason why they cannot be carried out satisfactorily.

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

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

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

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

We also expect to conduct our own independent analysis to support our review of the DOE documents and to assess risk significance. We are doing these analysis to examine -- to look at the effects of rockfall impact on the design of drip shields and waste packages and to look at the effects of drift collapse on the drip shields and waste packages, on seepage into drifts and on waste package temperature. We will also do some scoping size -- block size distribution analysis that will evaluate DOE's design basis rock size and the frequency of beyond design basis rock size, if I might use that kind of expression.

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

The analysis that the DOE did previously met certain assumptions about it -- connections of how the base of the drip shield is connected and all that. And by looking at the impacts of this, we were about to decide among us that that particular design would not be good to satisfy the rock impact that was the design basis at that time. But I think DOE people are aware of these and we have been told that the assumptions is maybe in the design or maybe in the design basis rock, but we haven't seen where the change will be.

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

The capillary barrier arising from -- if water heats an opening -- water tries to intersect an opening around such a medium, the water is going to flow around -- flow along the surface of the solid. So the tendency to flow into the opening is reduced and only about five percent of the water is actually going through. On the other hand, if you look at this block size, the solution comes from a simulation that was done at the Center. This is just one realization that could be obtained from the Yucca Mountain fracture that -- they are all realizations, so this is just one example.

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

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

There are other potential effects of drift collapse. This was just shows that there is a variability of the kind of results that may be expected, different types and degrees of drift collapse. This one, for instance, would be at the early stages of collapse or maybe a collapse in the relatively stable rock that has very little fracture control. This will be early stages in vertical fracture control, final stages of that. And the kind of thing we can expect from horizontal fracture control, the collapse.

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

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

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

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

MEMBER LEVENSON: Yes. I have one.

MEMBER GARRICK: Microphone.

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

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

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

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

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

MR. NATARAJA: That's right.

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

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

MEMBER LEVENSON: But that -- okay.

CHAIRMAN HORNBERGER: Ray?

VICE CHAIRMAN WYMER: I had just a couple of things. I couldn't help but wonder why if they're designing the drip shield to withstand a rockfall impact, and that's part of their argument, why they're also doing that for the waste package or visa versa. If they're designing the waste package to withstand rockfall, why the drip shield?

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

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

MR. OFOEGBU: Well, those are all possibilities. The previous DOE analysis actually assumed they fall flat, and it's one of the things that we were not happy about, and there is an agreement item under the technical seal list area to consider point impact.

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

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

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

MR. OFOEGBU: Yes, yes.

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

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

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

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

MR. OFOEGBU: Okay. The point that -- let me now go into it. The point there is that when the drift if filled with broken rock, the role is radiation is going to be removed and you're going to have conduction through broken rock and maybe convection through the pore space that is still available.

VICE CHAIRMAN WYMER: That's all I have.

MR. AHN: Can I --

CHAIRMAN HORNBERGER: Tae Ahn?

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

PARTICIPANT: That's sort of go back.

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

CHAIRMAN HORNBERGER: John?

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

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

MR. OFOEGBU: Okay. Thank you.

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

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

MR. DASGUPTA: Good afternoon. My name is Bis Dasgupta. I'm here to present to you the preclosure aspects of the RDTME KTI. I would like to first acknowledge the contributions of the NRC and the Center staff. From the number of participants, you can guess that there has been quite an increased activity on the preclosure in the past year.

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

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

The next three slides actually summarizes the ten preclosure topics that DOE needs to address before the license application. The subtopics and key concerns and the number of agreements that has been reached. The total number of agreements were about nine, and in addition to these agreements there were three position papers that were developed by NRC. I'm not going to go through the details of these three slides, but I would like to, however, point out that the identifications of these subtopics and concerns were based on limited, focused, risk-informed review. And some of the concerns were of higher level or general in nature, and some of them were specific.

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

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

As regards the naturally occurring and human-induced hazards and initiating events, NRC has discussed only two hazards in this technical exchange. One was aircraft crash hazard, and the other is tornado missile impact on the waste package. NRC has pointed out that the exclusion of aircraft crash hazard as a potential hazard in the preclosure period is kind of premature. NRC stated that DOE should provide detailed analysis taking into account all types of aircraft flying in the vicinity, including the reasonable projections of the future activity. Flight modes of military aircraft and combat training aircraft should also be included in their analysis. DOE will assess these hazards and will provide updated reports on the aircraft crash hazard analysis.

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

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

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

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

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

In addition to the analyzed dose approach, which DOE is using for performance objective, for showing the compliance with the performance objective, NRC has pointed out that DOE should also look into the individual event dose limits, and that they should comply with the regulatory dose limits. And also consider multiple events occurring in a single year, and that multiple event dose should also be complied with the dose limits. One of the important outcomes of the preclosure safety analysis and also requirement of Part 63 is that the structure system components important to safety should be identified.

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

The design information of structure system and components important to safety, there were three aspects that were discussed. One was a preclosure criticality issue, burn-up credit, waste package drop of numerical modeling and waste package fabrication process. DOE will provide updated preclosure criticality analysis and resolve the burn-up credit. There was an agreement on that. As regards the waste package, DOE will provide additional information on final modeling of waste package drop analysis, for example, the mischaracterization, boundary condition, failure criteria used. This was one agreement that was reached.

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

What does NRC need to do before LA? One aspect of work is to assess DOE issue closure. DOE will provide the data model analysis as part of the agreement, and our job is to review that DOE has fulfilled the agreements or not. Complete development of PCSA tool. This is a tool that we are working on to review DOE preclosure safety analysis. Develop confirmatory hazard identification and failure rate database. Review DOE documents on preclosure safety analysis. We will perform limited analysis using the preclosure safety analysis tool or any other modeling that we're required to do in order to satisfy us that the DOE's calculations are in the right direction. Conduct NRC and DOE technical exchange on remaining preclosure topics. Those concerns, as I said, will be raised as the review progresses. Prepare preclosure section of integrated issue resolution status report. That's an ongoing process.

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

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

We have also reviewed and looked into the incorporation of human reliability and software reliability analysis in the preclosure safety analysis. We reviewed the basic concept of selected methodologies from considerable research and guidance developed by NRC on human reliability analysis. We explored the significance of software reliability and reviewed basic concepts of methodology from research and guidance again developed by the NRC. This software reliability, I want to clarify, is that DOE is planning to use remote operations in the preclosure in the surface and subsurface facility operations, so we'd like to look into that reliability of the hardware and software in those remote operations and what sort of hazards that they can lead to.

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

The work plan for fiscal year 2002, we would like to incorporate the human reliability and software reliability capabilities in the tool, primarily to review DOE's work, incorporate probablistic safety assessment capability, improve on the existing features based on the NRC and Center staff feedback. This would be an ongoing process. We would like to fix whatever problems that we have with the tool, and this is therefore that we will devote ourselves in this year. Review DOE documents and preclosure safety analysis, including limited independent analysis, prepare for NRC/DOE technical exchange for an Appendix 7 meeting, including identification of key concerns, continued preparations of preclosure section of the integrated issue resolution report, and continue development of hazard identification database.

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

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

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

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

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

CHAIRMAN HORNBERGER: Thanks. John?

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

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

CHAIRMAN HORNBERGER: Yes, the tool.

MEMBER GARRICK: Tool, yes.

MR. DASGUPTA: Yes, preclosure safety assessment.

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

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

MR. DASGUPTA: Yes. I think there's a lot of activities going on in that preclosure safety analysis area, in the tool development area. First of all, I'd like to say that this tool really combines the methodology that has been used in the integrated safety analysis concept and the softwares that are used in the preclosure -- or PRA business. So we are not doing anything new. It's only that we are sort of keeping all these different gradients under one umbrella.

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

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

63 Category 1 performance objectives and Category 2 performance objectives.

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

MEMBER GARRICK: Yes.

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

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

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

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

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

MEMBER GARRICK: Yes.

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

MEMBER GARRICK: Thank you.

CHAIRMAN HORNBERGER: Raymond?

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

MR. DASGUPTA: It says, "developed." Well, it's an ongoing process, actually, because we started this component failure rate database as well as hazard identification database, and we thought that we probably have reached, but there's a lot of information out there. We are researching on it and then putting things. So it's not complete. Yes, it's an ongoing process.

VICE CHAIRMAN WYMER: Okay.

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

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

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

VICE CHAIRMAN WYMER: Sorry, of the what?

MR. DASGUPTA: Nearby military activity and the industrial activities around the Yucca Mountain area. I think there are a lot of information that we need to process before the license application, because DOE has to analyze that hazard, taking all the data into consideration. And then we are trying to do a proactive job to develop that database also, because when the license application comes, it will be very difficult within a short period to process this data and to --

VICE CHAIRMAN WYMER: Okay, thanks.

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

(Laughter.)

Milt?

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

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

MEMBER LEVENSON: Yes, yes. Yes, yes.

MR. DASGUPTA: Yes.

MEMBER LEVENSON: Not the process of transportation.

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

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

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

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

MR. DASGUPTA: Yes.

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

MR. DASGUPTA: Yes.

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

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

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

MEMBER LEVENSON: Okay, okay.

MR. LESLIE: -- and exchanges.

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

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

CHAIRMAN HORNBERGER: Questions from staff?

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

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

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

MR. LARKINS: It will be an iterative process.

MR. DASGUPTA: It is iterative process.

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

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

MR. LARKINS: Okay.

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

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

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

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

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

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

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

As a result of the meetings, the 37 key technical issue subissues are currently categorized as either closed or closed-pending, and in the backup slides I've included the definitions for closed, closed-pending and open, and I've also provided a table that lists all the key technical issues and the subissues and their current status in one place. So if you need to look at those.

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

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

CHAIRMAN HORNBERGER: Jim, let me try to get a little clarification on that. Yesterday, John Garrick and I spoke with Commissioner Merrifield, and he expressed an interest in knowing from the KTIs which ones were potholes, speed bumps or road blocks. On the 293 exchanges -- or agreements, rather, how many of them would you say fell into this category of, "Please give us a data file on this or give us your data on this"? That's number one, and maybe they're potholes, I don't know. And how many of them are detailed requirements for, let's say, two years of data collection?

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

CHAIRMAN HORNBERGER: Right.

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

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

MR. ANDERSON: No. There's a lot less than that are category of the data files. I would say the majority of the agreements are -- I don't know if it was Bret or someone else in the presentation characterized them as, you know, if DOE said they were exclude something in TSPA, we wanted additional justification or technical bases for why they're excluding it. I think most of the -- and if I'm speaking, Bret, you can correct me -- but I think most of them fall into that type of category more so than the data files category.

CHAIRMAN HORNBERGER: Okay.

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

And it's true that a large number of them are just requests for reports and existing data and what have you, but there's probably some number, 50, that require a level of effort that maybe is multi-man year, I don't know. Some sort of a comprehension of what we are really talking about here would certainly be helpful.

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

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

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

MR. ANDERSON: Well, I think we took a very quick look at with Bret's table. I don't think -- there's just too many variable, especially with the possible design changes and things like that. Some of the agreements could take a long time if they do one design but could take very little if they do a different design. So I think an effort like that on the NRC side I think -- I don't know if it's fruitful.

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

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

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

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

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

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

MEMBER GARRICK: I'm sure you're right, and all we're trying to do is to help this process of communicating with the outside world.

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

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

(Laughter.)

CHAIRMAN HORNBERGER: They don't.

(Laughter.)

MR. ANDERSON: Moving onto the next slide, for the fiscal year '02 agreements, and those I mean the agreements which were due in fiscal year '02, DOE submitted the information mostly on time. And by what mostly on time I mean is within a month of the due dates. We've reviewed probably about half of those agreements, and additional information has been needed on several of those. We're in the process of issuing three or four additional letters, which will cover the rest -- I shouldn't say the rest -- almost all of the rest of those agreements. Those should be issued hopefully within the next couple weeks.

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

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

Next area I was going to address was the current NRC staff activities. Planning future issue resolution meetings. I've been internally referring to this as round two of issue resolution. In round one, we kind of -- we've discussed all the KTIs, we tried to identify the information gaps the NRC felt needed to be filled by DOE. And during this next round of issue resolution meetings, I hope to focus on those agreements and any new information/design changes that might have come up since the last meetings and try to refine that information gap. With 293 agreements, I'm sure we haven't nailed down exactly in words exactly what we want, so I think there's room for discussions between NRC and DOE to really focus on what exactly do we need.

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

And by those I mean how we're communicating the status of current activities just so when we do get documents in, they're not surprising to us. Or when we issue reviews and stuff, they're not surprising to DOE. So that's what I'm hoping to accomplish in the early February meeting, and I already mentioned that hopefully in March we'll discuss the DOE plan.

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

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

Bret really hit this one earlier, but I'm just going to try to recap it a little bit -- risk insights and the issue resolution process. As we've discussed with you in the past, the NRC has used risk insights in preparation for issue resolution meetings, the round one meetings, as I've been calling them. As we move forward into the next round with DOE, DOE has been looking at these agreements, I'm pretty sure, from a risk point. And using Bret's initiative and some of the information we'll get out of that, we can go into those meetings and really focus on the agreements and see just to make sure we're asking the appropriate RAIs, as Wes called them.

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

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

MR. ANDERSON: Categorize the subissues?

MR. LARKINS: Yes.

MR. ANDERSON: It could.

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

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

MR. LARKINS: Combined group package.

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

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

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

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

MR. ANDERSON: At that, I will. Moving on, just a quick status of where we're at with the integrated issue resolution status report. This has been a work in progress for quite a while, and it will document the status of issue resolution. It will follow the Yucca Mountain review plan format, and we expect to issue it sometime hopefully in the next few months, spring of 2002, which is on the slide there.

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

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

So I guess with that -- I guess I didn't point out during my presentation, I mentioned the subissue table in the backup documents. There's also another table which outlines all the agreements, and the slide before that has the five categories I used to status the agreements. So that last table is hopefully to capture the status of all the agreements in one spot. So with that, if there's any questions I can try to address or I can hand off to someone else.

CHAIRMAN HORNBERGER: Thanks very much, James. John?

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

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

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

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

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

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

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

MEMBER GARRICK: Thank you.

CHAIRMAN HORNBERGER: Milt?

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

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

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

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

MEMBER LEVENSON: Well, maybe a major effort. That's not really the question. A major effort implies that if they put some people on it, they can do it. That's not necessarily a show stopper.

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

MEMBER LEVENSON: Right.

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

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

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

(Laughter.)

MR. LESLIE: I was only imitating my boss.

(Laughter.)

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

(Laughter.)

CHAIRMAN HORNBERGER: Any other questions? Latif?

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

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

MR. HAMDAN: So when you take --

MEMBER GARRICK: We're not offering a license.

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

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

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

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

CHAIRMAN HORNBERGER: Please.

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

And in that category, some of those are where we provided what we thought was appropriate, but a lot of it was based on judgment, a lot of it was based on -- I'll put it this way: Whenever some of our technical people write a report, as all technical people do, they understand it very well. But oftentimes it doesn't come across very well to the reader or understandable. So that's the traceability issue, the transparency issue, and a lot of that is in the category of documentation. And many times we have an agreement that says, "Provide a technical basis or the DOE provide a technical basis or basically other evidence on how you are proceeding with regard to an agreement."

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

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

MR. WILLIAMS: Hundred and eighty-eight.

MEMBER GARRICK: Okay.

MR. WILLIAMS: Which constitutes 64 percent.

MEMBER GARRICK: Okay. So that --

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

MEMBER GARRICK: These others are the subs of that.

MR. WILLIAMS: Right. Right, the numbers

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

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

We have a pretty good idea that we can work out these things, because we've ran the plans out, we've ran the scopes out. We have a pretty good idea of what scope we need to have to satisfy these agreements. The only problem is it extends out for quite a period of time, and now we're in the process of figuring out how do we refine that, how do we run some things in parallel, how do we make it come in a little bit sooner?

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

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

CHAIRMAN HORNBERGER: Good. Thank you.

MR. LARKINS: Can I ask a quick question?

CHAIRMAN HORNBERGER: Yes. Go ahead.

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

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

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

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

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

MR. ANDERSON: No problem.

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

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

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

(Whereupon, at 5:05 p.m., the recorded portion of the ACNW Meeting was concluded.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: 131st ACNW Meeting

Docket Number: (Not Applicable)

Location: Rockville, Maryland

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Pippa Antonio

Pippa Antonio
Official Reporter
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