UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

***

BRIEFING ON

STATUS OF ACTIVITIES WITH CNWRA

AND HLW PROGRAM

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PUBLIC MEETING

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Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Commissioners' Conference Room
Rockville, Maryland
Wednesday, August 26, 1998

The Commission met in open session, pursuant to notice, at 2:08 p.m., the Honorable Shirley A. Jackson, Chairman, presiding.

COMMISSIONERS PRESENT:

SHIRLEY A. JACKSON, Chairman of the Commission
NILS J. DIAZ, Member of the Commission
EDWARD MCGAFFIGAN, JR., Member of the Commission

STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

JOHN C. HOYLE, SECRETARY OF THE COMMISSION
KAREN CYR, GENERAL COUNSEL
HUGH THOMPSON, EDO
CARL PAPERIELLO, NMSS
JOHN GREEVES, NMSS
WESLEY PATRICK, CNWRA
MICHAEL BELL, NMSS

P R O C E E D I N G S

[2:08 p.m.]

CHAIRMAN JACKSON: Good afternoon, ladies and gentlemen. The purpose of this afternoon's meeting is for the NRC staff and the Center for Nuclear Waste Regulatory Analyses -- or simply the Center, as we will refer to it in this briefing -- to provide the Commission with an update on

the status of the NRC high-level waste programs and activities at the Center.

The Commission is pleased to welcome Dr. Wesley Patrick from the Center, who will be providing at least part of today's briefing. The last time the Center briefed the Commission was in May of 1997, and I'm not sure exactly what the interleaving of the discussion will be since I'm told that both NRC staff and Dr. Patrick are working from the same viewgraphs.

So Mr. Thompson, the Commission looks forward to hearing from both the NRC staff and the Center today on the status and accomplishments and what we have to look forward to with respect to the NRC's high-level waste program.

So unless my colleagues have anything to add, you may begin, but maybe you can introduce everyone and explain how you intend to carry this out.

MR. THOMPSON: Thank you, Chairman, and good afternoon, Commissioners.

You are correct, we will have a briefing by both the staff and the center today, and the staff obviously will talk about the high-level waste program, and the Center, with the technical focus and technical support of the staff, will focus on technical accomplishments, and Mike Bell, who is the chief of the Performance Assessment and High Level Waste Integration Branch, will do the staff briefing, and Wes Patrick will do the briefing for the Center. I think you know Carl Paperiello and John Greeves from the NMSS.

So with that, Mike?

MR. BELL: Good afternoon, Chairman. Good afternoon, Commissioners. It's a pleasure to be here to update you on the status of the high-level waste program.

As the Chairman mentioned, May of '97 was the last briefing, and at that time, we were in the second year of a very restricted budget. We had restructured our program to focus on ten key technical issues most important to repository performance in the first of those two years.

In the second year, we had to zero out the Center work in three of those areas, and I'm happy to report that this fiscal year, with increased funding, we are now working again in all ten areas and making good progress, and I hope we will reflect that in today's briefing.

I would like to start out basically with an overview of the goals, strategies of the program, talk a

little bit about how it's organized.

Wes will talk about some of the technical accomplishments to which the Center has contributed.

Since we're very late in the fiscal year for this briefing, we will also give some looking ahead to what we might be seeing in Fiscal '99, and then we will summarize.

The slide 3 shows the goals of the program from the agency's strategic plan. Basically, the first bullet shows the overall goal for the Waste Management Division, and then the second goal is the present goal in the '97 strategic plan for the Waste Management Program, and it focuses on putting n place the regulatory framework for regulating the waste disposal at Yucca Mountain.

That framework consists of an implementable EPA standard, NRC's implementing rule, and then a Yucca Mountain plan by which we conduct licensing review.

On slide 4, --

CHAIRMAN JACKSON: You didn't mean for disposal of waste at Yucca Mountain; you mean for the work related to --

that we have to do under the law vis-a-vis the assessment of Yucca Mountain and our various pre-licensing and licensing activity? Presuppose the judgment if you took it at its face value.

MR. BELL: Yes. Assuming the site is found suitable.

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MR. THOMPSON: That's correct.

CHAIRMAN JACKSON: That's right.

MR. BELL: Okay. Absolutely.

Slide 4 basically shows the strategy for our approach to the high level waste program to put the regulatory framework in place.

Since the publication of the National Academy Technical Basis Report in 1995, staff have been working with EPA to try to get in place an implementable standard for Yucca Mountain. We have been sharing with EPA staff the results of our own analyses of repository performance and having discussions with them on what a technically sound implementable standard should be.

Because that standard is taking so long to get in place, the staff provided to the Commission in December of last year a paper on a strategy to proceed to start development of its own implementing rule, which was approved in March of this year.

Work is underway to develop a site-specific standard for a repository that might be built at Yucca Mountain, 10 CFR Part 63, and the staff is on schedule to get a proposed rule to the Commission by the end of September of this year.

As I mentioned earlier, in --

COMMISSIONER McGAFFIGAN: Could I just ask a

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question on that point? We had a meeting yesterday -- Carl was here -- and we talked about the advantages of the Part 35 approach to rulemaking that -- where we had draft rules out on the Web before the proposed rule came to us, and some significant discussion of issues occurred prior to the rule coming to us.

With it only a month away, you're probably already sending us the paper, getting it in through the system, but is there any advantage to getting the Part 63 rule out knowing that it's a pre-decisional -- I mean, we haven't decided to endorse it, but just to get the advantage of an extra month's comment on it?

I just throw it out as a question. I don't have a preconceived answer to it.

MR. THOMPSON: I don't think we've probably thought of that one either, but I think it's a good question and we'll, I guess, discuss it amongst ourselves and get back and make a recommendation if we think we want to. But I do appreciate the fact that --

CHAIRMAN JACKSON: What would be -- in a certain sense, one could perhaps handle it another way, but I don't think it presupposes anything, which is perhaps to just have an extra month built into the -- but it depends on the schedule in terms of the public comment period.

Yes?

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MR. BELL: Chairman, I mean, the current plan is that when approved by the Commission, --

CHAIRMAN JACKSON: Yes.

MR. BELL: -- a proposed rule would be put on the

Web page --

CHAIRMAN JACKSON: The Web.

MR. BELL: -- and we would be accepting comments on it in that manner.

MR. THOMPSON: Mike wasn't at the briefing yesterday. I can explain --

COMMISSIONER McGAFFIGAN: The only advantage, and we may not have the advantage in this instance of having it out on the Web page, even as you guys are working on it is that sometimes there is a narrowing of issues that occurs before the proposed rule, and if that -- if that's a possible advantage in this case, I would be for it; if it isn't a possible advantage because of the constraints we're under, then I would defer to the staff on it.

MR. THOMPSON: Okay. We'll take that under consideration.

MR. BELL: As I mentioned earlier, back in 1996, we refocused the program to concentrate on the ten key technical issues most important to repository performance.

The program focuses on trying to achieve resolution at the staff level of these issues. To

accomplish this, each of these issues is broken into several sub-issues.

As an example, there is an issue dealing with igneous activity at Yucca Mountain. The two principal sub-issues are what's the probability of vulcanism destructing the repository, and then, if that were to happen, what are the consequences?

Basically, to resolve that key technical issue, both sub-issues need to be addressed, and in fact, later in the talk, one of the examples Wes will be talking about will be the work that has been done on the probability of vulcanism.

The vehicle by which we communicate with DOE on our issue resolution program is an issue resolution status report. These are documents which lay out the importance of the issue to repository performance, how the staff is going about reviewing the issue, what the staff's acceptance criteria for an acceptable resolution is, and then basically the status of achieving a resolution on the issue.

CHAIRMAN JACKSON: Let me just -- well, okay. I just wanted to know, what is the current schedule to receive the viability assessment, and will the high-level waste program be ready to do its review?

MR. BELL: I have a couple slides about the review of the viability assessment later. We can either talk about

it now or take it up in turn.

CHAIRMAN JACKSON: Well, you can just tell me what the current schedule is and I'll be ready.

MR. BELL: Basically, the schedule is that the Department of Energy staff will get it to the Secretary of Energy in September so that it is available to be published at the end of this fiscal year.

That's as much information as we have. Essentially whether or not it will be released then or --

CHAIRMAN JACKSON: Well, my question really relates to our review of it and how does that --

MR. BELL: Well, we feel that we will be in a position to review it if it comes out the first of October. Basically, all the work that we have been doing on issue resolution of the KTIs is preparation for review of the viability assessment.

CHAIRMAN JACKSON: Okay. So the way it's going to work is that it's going to be approved for publication by the Secretary of Energy before it would come to us --

MR. BELL: That's right.

CHAIRMAN JACKSON: -- for any review; is that the point?

MR. THOMPSON: Right.

DR. GREEVES: But we are ready October 1st effectively -- we're saying that by October 1st, if that

were the day, we have got a plan in place to be in shape to do this.

CHAIRMAN JACKSON: Okay.

DR. GREEVES: In fact, we're getting pieces of things. Mike is going to mention some of the things --

CHAIRMAN JACKSON: Okay.

DR. GREEVES: -- we're getting early.

CHAIRMAN JACKSON: Okay.

Yes, Commissioner.

COMMISSIONER McGAFFIGAN: The issue resolution status report, there is one for each of the ten key technical issues and they are updated periodically?

MR. BELL: They are -- the ten key technical issues, one of the issues involves review of the EPA standard and developing the rule.

COMMISSIONER McGAFFIGAN: Okay.

MR. BELL: There is no issue resolution status report in that.

COMMISSIONER McGAFFIGAN: But for the other nine?

MR. BELL: The other nine will have issue resolution status reports developed. In fact, we have already transmitted to DOE eight of them, and by the end of this fiscal year, we will have documents out on all nine.

COMMISSIONER McGAFFIGAN: And are these documents -- you don't say you -- the eight that you've already sent,

they don't say we've resolved the issue; they say, --

MR. BELL: No.

COMMISSIONER McGAFFIGAN: -- here is the process for resolving the issue?

MR. BELL: They're in various stages of resolution.

COMMISSIONER McGAFFIGAN: Okay. And is the public given a copy of these? Do they go into the PDR or whatever?

MR. BELL: Basically, what we're trying to achieve here is resolution at the staff level, reach the point where on a technical issue, the staff has no further questions or issues with what --

MR. THOMPSON: This dialogue --

MR. BELL: They are all provided to large distribution lists that includes the state, the local governments, industry.

DR. GREEVES: DOE has commented back on six of them, Mike, already?

MR. BELL: That's right. The feedback is DOE finds them helpful to --

CHAIRMAN JACKSON: Right. And so basically, all of the entities and groups encompassed in your last bullet on this slide basically --

MR. BELL: They're on standard distribution, that's correct.

CHAIRMAN JACKSON: They're involved and aware.

Actually, a question I had, going back to the rulemaking, have these same groupings had any opportunity or involvement relative to the actual rulemaking, Part 63?

MR. BELL: Well, basically, we have briefed -- at the high-level waste conference in Las Vegas last May, we presented a paper essentially on the strategy that the staff is using to develop Part 63. We briefed the ACNW in a public meeting. We have taken the opportunity to present papers at other conferences.

We have not essentially -- if you're asking about soliciting input on what should be in Part 63, we have not reached that stage yet.

DR. GREEVES: There was a meeting with the public that Mike conducted out there in May, in the evening, to try and facilitate that process, and we have a question, don't we, in from affected units of local government? They want to come in and meet and subsequently meet with the Commission. I have a letter in from them.

MR. BELL: Yes. There was a public meeting the 15th of May that -- we took advantage of an opportunity. Since we were in Las Vegas for the high-level waste conference that one evening, we held a public meeting. But it did not really focus on Part 63; it was more the program, what's NRC's role, how we interact with DOE in this

prelicensing consultation.

CHAIRMAN JACKSON: Commissioner?

COMMISSIONER McGAFFIGAN: Just one other question about how this process with the issue resolution standard status reports works.

You sent eight over. You've got six back. It's transparent. Is anybody else participating in the dialogue, say the Nuclear Waste Technical Review Board or these entities in Nevada or whatever? Are they watching the paper flow and taking it seriously and --

MR. BELL: Well, there are any number of people watching this program. The ACNW, you know, has been briefed. In fact, there have been several letters to the chairman on either individual technical issues as well as on the whole process.

We have made presentations to TRB on some aspects of the work. The -- you know, we try to keep the process as open as we can to have people have visibility.

DR. GREEVES: Mike, just to give the Commission a feel, we had a meeting with DOE, I believe it was last week, and we do these video-conferencing, and the stakeholders are at this meeting. They're sitting there across the TV, if you will. And in this particular one, I believe some of the elected officials in Nevada were in the audience on the other end.

So they are paying attention. Are they writing letters in and comments on a specific IRSR? I don't think they're doing it that level of detail, but they are participating in our meetings in the sense of being there. They have an opportunity to ask questions, make comments.

CHAIRMAN JACKSON: What you're basically saying is that in a certain sense, this is, you know, a technical issue resolution process as opposed to a rulemaking process. So there are some nuances of difference, but you're saying that all of it has, you know, been in the open, had the various stakeholders.

MR. BELL: That's right. And there has been -- one example, the KTI dealing with seismicity, in that case,

the state actually had its own experts with their own seismic models, and they made presentations to the NRC and DOE staff that were taken into account when we developed our issue resolution status report.

Slide 5. The status of Part 63 is that it's out for office concurrence at the present time. Essentially, the staff has completed its working draft. To, you know, get additional input at this time would, in fact, slow the process down, but -- and we're looking forward to getting input during the comment period.

As I noted, eight issue resolution status reports have been issued. The ninth, the one dealing with

radionuclide transport, geochemical retardation during transport, was one of the areas that was zeroed out at the Center last fiscal year, and so that one is behind, but work is now ongoing. As I mentioned, by the end of the fiscal year, we will have an IRSR out in that area, plus we will have updates for the others.

Another major accomplishment is the improvements that have been made to our total system performance assessment code. We used to have a code that only ran on the mainframe and had to be done by the contractor. Within the last year, we have made it more user-friendly, brought it in-house. It can be run on a workstation. NRC staff routinely use it in their work.

One of the reasons this is very important is that this is the tool that the staff will use to review the license application. When you want to make judgments about what's important to performance and implement a risk-informed performance-based licensing program, this is the tool that we would use to do that.

Basically, it's the framework that we're using to support Part 63 for reviewing the DOE's program and for prioritizing our own program.

The next to the last bullet on slide 5 -- just let me expand a little bit more on that because I think the earlier discussion may have been somewhat confusing.

Chairman, you asked will we be ready to review the VA in October or whenever it comes out. Basically, through the interactions we've already been having with the Department -- for example, reviewing its total system performance assessment -- we're already reviewing parts of the document.

All of the work the staff has been doing really in Fiscal '98 is getting in a position to do a very rapid review of the viability assessment when it comes out.

CHAIRMAN JACKSON: Yes, Commissioner Diaz and Commissioner McGaffigan.

COMMISSIONER DIAZ: Yes. All of these interactions and development of the key technical reviews, where are we with EPA? What are our interactions with EPA? How -- are we divergent or convergent on whatever issues we have?

MR. BELL: Well, EPA is really interested at a much higher level, what the overall performance standard would be. Much of the interacting that takes place with the department, the technical work that goes on at the KTI levels, are technical aspects that have to be considered in performance so that you can assess the performance of the entire system against that standard.

This is the kind of information we're sharing with

the staff of the EPA, like the -- I mean, types of

assessments that have to be done of groundwater systems and what it takes to calculate those, and the approximations and assumptions that have to be made in those --

COMMISSIONER DIAZ: I understand, but what I am asking is when we make these interactions, are we convergent in a series of issues that might allow us to get some reasonable distance within EPA when actual -- you know, the standards are promulgated for the potential site, Yucca Mountain. Is there a convergence process going on or --

DR. GREEVES: You might have thought we could have, you know, prior to now had some convergence. I mean, I think we know what the issues are, the decommissioning program, et cetera. There's a couple of tough issues laying out there.

I think all the work that Mike and the staff are doing, we have to do that regardless of what the standard is. We have to --

COMMISSIONER DIAZ: Oh, I understand that. Since we are communicating with the public and DOE and so forth, I was wondering how are we communicating with EPA.

DR. GREEVES: We're communicating.

COMMISSIONER DIAZ: All right.

[Laughter.]

DR. GREEVES: Not always agreeing, but we're communicating.

CHAIRMAN JACKSON: Is it fair to say that you're communicating, but there's not convergence --

MR. THOMPSON: We haven't reached agreement on a number of key issues, and I think we're continuing to recognize those important ones, to have an open dialogue, and we continue to do that. So we will continue our efforts to have a full disclosure and discussion of the issues.

CHAIRMAN JACKSON: Okay.

COMMISSIONER McGAFFIGAN: This is a related question, really. What is the overall performance standard that DOE is using in its viability assessment? And what are -- when we review it, and you say you're ready to review it in your response to the Chairman, are you going to be reviewing it against a performance standard as well, the one that we suggested to you all in the Part 63 rule or --

MR. BELL: Yes. The staff, for its work, is using a 25 millirem pathway standard, --

COMMISSIONER McGAFFIGAN: But is DOE --

MR. BELL: -- and I believe that's also what DOE will be considering in the --

COMMISSIONER McGAFFIGAN: And these other issues that are out there, the 10,000 years peak dose, et cetera, you have -- I mean, if I were DOE at the moment, not you, and I was trying to figure out how to write a viability assessment, and I didn't have a standard yet promulgated, it

would be a little hard.

So I guess I would choose one and then -- well, did they end up talking about multiple standards if the standard were X and if the standard were Y, or how are they going to deal with that? Did they end up talking about multiple standards if the standard were X and if the standard were Y, or how are they going to deal with that?

MR. BELL: The viability assessment is not a licensing document.

COMMISSIONER McGAFFIGAN: I understand.

MR. BELL: Basically, they are not going to try to show that they have a licensable facility or that they meet any particular standard. They basically are going to say, here's our reference design, here are some alternative designs we're considering, and here's how they perform, and here's what it will cost to --

COMMISSIONER McGAFFIGAN: The "here's how it performs" I think is the interesting question because the -- you know, I may -- in doing that, they're going to have to say here's how it performs over an extended period of time and here are some reference values for how we think the performance is.

MR. BELL: Right.

COMMISSIONER McGAFFIGAN: It's not a licensing document like you say, but it's a -- I think I remember the

former head of the DOE, Mr. Dreyfus, saying that the viability assessment was greater than 50 percent probability that it was worthwhile going ahead with -- I mean, they were just trying to get to the point where DOE thought that it was viable and there was a greater than 50 percent probability that it was licensable. If I recall properly, that's what he said to us. Therefore, you have to get at least a little ways towards this licensing discussion.

CHAIRMAN JACKSON: I think that really in some ways the question boils down, to me, to the following two questions. One is, has DOE selected some kind of a reference standard vis-a-vis their doing their own viability assessment. Two, part B, what are we using? And C, or B sub 1, do they comport, at least at that level? And I mean that's kind of abstracting it from whatever the EPA standard might be. But relative to kind of a working standard, what is DOE using, what are we using, do they comport?

MR. BELL: And I believe both DOE and NRC are considering the 25 millirem pathway.

CHAIRMAN JACKSON: Okay. So for this particular stage of review and for the viability assessment, that's where we are.

MR. BELL: That's right.

DR. GREEVES: And 10,000 years is a number that both DOE and Mike and I, when we meet with our counterparts

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CHAIRMAN JACKSON: Right.

DR. GREEVES: That has not been an area of --

CHAIRMAN JACKSON: I think it is important for us to understand and for the Commission to understand, you know, and if you're not totally sure, then maybe you can kind of get the answer to, you know, what is DOE using for its viability assessment, I think we know what you're using --

DR. GREEVES: Right.

CHAIRMAN JACKSON: -- and do they comport, and if they don't, where do they not, so we at least know -- I mean, because otherwise, we don't know what the reference point is, what the normalization point is. And then there's the separate issue of to what extent we're coming to any concurrence with EPA, although in the end, the way, you know, the Commission approved your doing the rulemaking was to leave it where you would have a placeholder, but we have to put in the EPA standard.

MR. BELL: That's right.

CHAIRMAN JACKSON: Right. Okay.

MR. BELL: I would like to move on to slide 6, where I try to show some of the activities that are currently ongoing and that we anticipate will take place in the coming years. And one of the things that I would like

to point out is that basically in Fiscal '98, our main activities are putting a regulatory framework in place and working on resolution of the technical issues.

In Fiscal '99, a number of new activities, starting off with a review of the viability assessment the first quarter of the fiscal year. About the middle of the fiscal year, DOE plans to publish its draft EIS, which the Commission is required by the Nuclear Waste Policy Act to adopt to the extent practicable, and in order to make a judgment like that, we'll have to conduct a review of it.

MR. BELL: We plan to begin in fiscal '99 to begin working on that third part of the regulatory framework, the Yucca Mountain Review Plan, essentially taking the work that's been documented now in the issue resolution status reports using those review procedures, acceptance criteria and tieing them together into a review plan that, at least for the post-closure review of the repository which is, we think, the key part to licensing, would be available in time for DOE to prepare its license application to the Commission in year 2002.

CHAIRMAN JACKSON: Let me ask two questions of you. Has DOE committed to finalizing its standard by any particular date? Has DOE committed to finalizing its standard by any particular date?

MR. BELL: Do you mean EPA?

CHAIRMAN JACKSON: I'm sorry, EPA. I'm sorry. You're absolutely right.

MR. BELL: Our best estimate from the discussions that have been taking place are that about the first of the calendar year they might be in a position to propose a standard.

CHAIRMAN JACKSON: Okay. Second question. Where does the -- I assume somewhere in here, inherent in here is the actual site suitability determination.

MR. BELL: Yes. Actually --

CHAIRMAN JACKSON: And that's something that we are legally required --

MR. BELL: The --

CHAIRMAN JACKSON: -- to comment on.

MR. BELL: -- third from the bottom line labeled Commission's sufficiency comments.

THE COURT: Commission's --

MR. BELL: Sufficiency comments.

CHAIRMAN JACKSON: Sufficiency comments.

MR. BELL: The triangle at the end of that line in the year 2001 is the recommendation that DOE has to make to the President on the suitability of the site --

THE COURT: Okay.

MR. BELL: -- which has to include in it the NRC's views as to the sufficiency of site characterization and of

the design work that's been done, so that basically these interactions of DOE take place in the year 2000, 2001. There is -- the line above it, though, is important groundwork for that. The way we see that taking place is that the department actually plans to submit to us a working draft of a license application later in fiscal '99 that the staff would review essentially for completeness, like an

acceptance review, give comments back to the department on where the work was still deficient so that they essentially would know two years before the license application was to be submitted what still had to be done.

That work would also provide the basis eventually for the Commission to be in a position to comment to the secretary to include in his finding for the President that the work was complete and, in fact, should lead to a situation where the license application that would get submitted to us in the year 2000 would be complete.

CHAIRMAN JACKSON: Let me just understand something. Are you saying, suggesting -- I mean, are you saying to us that the NRC review of the draft license application is the vehicle for the Commission making its sufficiency comments?

MR. BELL: It's the tool that we have available to us. I think it's a perfect tool for the staff to have that stuff in front of the staff that we can be making comments

and --

CHAIRMAN JACKSON: Well, but isn't there a subtlety of a difference between the sufficiency of the application in terms of the groundwork that's covered and all of that versus the sufficiency of the information? I mean, it strikes me that --

MR. BELL: We would not be trying to make the licensing decision.

CHAIRMAN JACKSON: Okay, right.

MR. BELL: Only, you know, is this a complete application.

CHAIRMAN JACKSON: Okay, and so then our statement then, back to DOE, is that this is a complete license application. You know, we're happy with it as a license application and therefore that is our vehicle by saying that DOE's site characterization and all of that is sufficient. Is that what you're telling me?

MR. BELL: That's right, or we may find ourselves in the position that you have some models, some data that you don't at the present time have an adequate basis for and you know, is part of your performance confirmation program for the repository. Do you need to gather additional information.

CHAIRMAN JACKSON: Well, I think it's important that the Commission understand what the specific elements

are that form the basis of the sufficiency comments, and how they play or don't play against the elements of a license application, okay, but without putting the Commission in the position of de facto making a judgment on the license application --

MR. BELL: Yeah --

CHAIRMAN JACKSON: -- before we actually have a process, a licensing process.

MR. BELL: The staff's understanding of what we need to provide to the Commission for the sufficiency comments would essentially be something that would be akin to an acceptance review for an application, essentially saying --

CHAIRMAN JACKSON: Okay. Well, I think you need to propagate that to the Commission.

MR. THOMPSON: We'll do that. It will be part of that process.

CHAIRMAN JACKSON: Sure. Okay, Commissioner?

COMMISSIONER DIAZ: Yeah, and I am sure that you have looked at all of these activities and already of kind of determining when will the NRC activities be in the critical path and you're ready for that if we -- we'll supposedly be at the critical path sometime when things come together, and when will that happen. Have any idea? If everything goes according to this program schedule, what

activities will be in the critical path and are we ready for those activities?

CHAIRMAN JACKSON: This is more having to do with an integrated schedule, I think, and insure that we're not at the pinch point.

MR. THOMPSON: I would just say what we're really doing is laying out the framework for us to be able to start our licensing review. Once we have the license application, we are clearly on the critical path at that time. That's why I think in some of the budget submittals we've given you -- you've seen some areas where the high-level waste program goes up for us to deliver those things which we believe are necessary to be able to do that licensing in the 18-month time frame which we have to do our review. We are -- we'll be clearly on the critical path when we get the license application.

CHAIRMAN JACKSON: Okay.

MR. PATRICK: Commissioner, if I could comment further on that. You know, this isn't really a PIRT diagram, but if you can catch the flow of some of the language here, what we're trying to communicate is we've started several things as early as we possibly could to be able to get as much information as possible in front of the Department of Energy, or in the case of the feedback we provided EPA, in front of them, with regard to what the

staff's thinking is.

In the case of the EPA standard, they were the critical path, but staff came to you some time ago indicating that that had delayed to the point that for the staff to be able to complete a rulemaking, we had to start, even in the absence of a rule.

That third line, though, is a critical one and Mike has touched on it several times. Those IRSR's contain a lot of information in them and more than that, they have the nuggets that feed into the Yucca Mountain review plan, which, if it isn't done on time, it becomes a critical path item. It is being used in our rulemaking activities. It's kind of a close loop there. Write a rule. See if it's implemental by doing your own internal test. If it isn't make some modifications to it, feed it back.

So, those acceptance criteria and review methods are crucial, and you can see from the chart which begins before '98 that we have done that, we've used that as a vehicle to feed into several of these other areas that could get on the critical path very easily were that work not ongoing at this time. It's going to be a matter of reformatting and reconstituting.

The other thing that those IRSR's contain in them is the results of our digestion and review of everything that the Department of Energy has sent forward. So, that's

considered in all of those issue resolutions, and that comes back to the point of we're looking at everything we can get our hands on in preparation for the VA coming out this fall and we'll continue that process all the way through the site

suitability process and eventually the license application.

COMMISSIONER McGAFFIGAN: The Yucca Mountain review plan, we're not going to have rev zero of that until fiscal 01, 2001. It strikes me that it would be, if I were DOE, again, I might have liked that to be sooner, and even if I'm the staff, I might want it to be sooner for the two things that follow, the reviewing the draft license application. I have to have something to review it against and then the staff comments on the sufficiency, the Commission's sufficiency comments. Is that a budget constrain issue?

MR. BELL: Yes, a budget constraint. Basically some of these activities essentially we're required to do either by law or as a practical matter. One of the few things on this chart where we can use it as a rheostat to adjust to fluctuations in the budget is the review plan. One of the things I did want to point out with regard to this table was all the new work that begins in '99 which is basically the reason for the increase in the requests for fiscal '99 that's under consideration down on the Hill now. Basically, if we get straight-lined at the '97 level, in

order to do these things that are down here, the only way to do it is once again, by cutting into the technical work and slowing down issue resolution.

COMMISSIONER McGAFFIGAN: And that's -- my next question, and I know it's already in the Chairman's letter to the Hill, but the impact at the House level as opposed to the Senate level, is this based on the Senate level?

MR. BELL: This is based on the 17 million level.

COMMISSIONER McGAFFIGAN: Okay, and the rheostat, as you say, if we get the House level, is the standard review plan --

MR. BELL: Well, that is stretched out even further --

COMMISSIONER McGAFFIGAN: -- gets stretched out even further.

MR. BELL: Other things will be impacted.

COMMISSIONER McGAFFIGAN: Other things -- that just strikes me, you know, as I say, we may be able to do it. Maybe there's a rev sub zero, a minus one or something that you would have that would be the stapling all the issue resolution reports together, but it does strike me that even though it's a rheostat, it might be important to some of the other items that have hard deadlines to them.

CHAIRMAN JACKSON: Maybe a digital process.

MR. BELL: In the absence of the review plan,

basically the department then is faced with having to go through individual issue resolution status reports and picking out the appropriate material rather than having an integrated review plan.

CHAIRMAN JACKSON: Dr. Paperiello?

DR. PAPERIELLO: Yes. I want to get back to the original question, critical paths. There are critical paths. The final rule has got to be done because the rule drives in some sense the KTI resolution, the licensing capability, the draft licensing application, and the Commission's sufficiency comments. This is the fundamental rule.

Secondly, the viability assessment that we owe you, and thirdly, the waste confidence paper that is also due the end of next year. So, for over the next year, those

things I think are the critical paths.

When you complete those, then you pick up the licensing capability and the draft licensing application. This is a unique animal. Most times you write standard review plans so they can be standard. Everybody is rated against the same plan. This is sort of a one-shot deal, and in a sense, when we talk about developing licensing capability and then reviewing the draft license application, this is the iterative process to communication with the public and the stakeholder process, only this is a unique

thing. We only have, you know, one applicant. There's a lot of different stakeholders. So, it's kind of a funny little thing, but I think that, in my mind, is what the critical path is, is the rule and waste confidence in '99, followed by the licensing capability and reviewing the license applications and along with sufficiency in the two years.

CHAIRMAN JACKSON: Where is the waste confidence on this?

DR. PAPERIELLO: The last slide.

MR. BELL: The last slide. Actually, we haven't had a chance to talk about that yet, but the Commission is committed to revisit this waste confidence --

MS. CYR: But I would say that you have, in the same way that you have statutory obligations to meet the others do you have a statutory obligation to complete a reassessment of your waste confidence on any particular time line. The Commission said at the last time it did it that it was about ten years or if they had some dramatic inquiry that they would go back and reassess that. It seems to me that that's something -- it does not have the same kind of, you know, binding requirement behind it in terms of the actual timing of when that occurs.

You know, if you really ran into some budget crunches in terms of getting things done, you might have

reason to say well, in a sense, I may have to slip that six months or something else in terms of the commitment to do that.

MR. THOMPSON: I'm not sure we have a binding requirement also in the viability assessment. I think there's -- I think we just anticipate that the Commission would want to know the staff's view and probably the Hill or others may want to know what the Commission's view is on that, so we probably would have to look at that.

CHAIRMAN JACKSON: And to the extent that the waste confidence decision itself addresses any potential points of vulnerability in a licensing proceeding.

MR. THOMPSON: Right.

CHAIRMAN JACKSON: It begins to be relevant.

MR. THOMPSON: Exactly.

CHAIRMAN JACKSON: Okay.

MR. BELL: I think we've pretty much covered everything on slide 7, and I'll just quickly touch on a couple of points on slide 8. Basically the work is conducted using interdisciplinary teams of NRC and Center staff. The Center under its contract has the capability to augment its staff with outside consultants. The work is overseen by a management board that we've established, essentially a team management concept where a representative of the division, the two branch chiefs within the NRC staff

involved, Wes, the president of the Center, and Booty Sager,

the technical director of the Center, have weekly conference calls where we do planning, set priorities, develop many of the budget and programmatic documents for the program.

On slide 9, I'd just like to touch on the recent ACRS ACNW report to the Commission that questioned the technical expertise and the flexibility that we have with our arrangement with the Center. I'd like to point out that within the NRC staff, 89 percent of the staff have graduate degrees, 46 percent are PhD's with an average of about 20 years of experience in regulatory matters.

CHAIRMAN JACKSON: You mean the ones in this particular program?

MR. BELL: With the NRC high-level waste program. Within the Center staff, 98 percent have graduate degrees, 67 percent are PhD's. The Center and the NRC staff both take part in international activities, including things like peer reviews of high-level waste programs in other countries. In fact, just today we learned that Booty Sager, the technical director of the Center, has been invited by the IAEA to advise the Brazilian government on its performance assessment model.

In addition, we have, as I mentioned, access to --the Center has access to 54 external experts from universities, industries, private consultants within the

southwest research institute itself which has a lot of technical capability.

The Commission, I think, is aware that R&D; magazine recently recognized the Center for its work on the 3D stress code with an R&D; 100 Award. Basically, that's an award that's given annually by that magazine for the 100 most technically significant innovations in the country. It's an award that's coveted by universities, industry, national laboratories, and we think it's an example of the kind of high quality work that the --

CHAIRMAN JACKSON: I'm familiar with it.

MR. PATRICK: I would say at this point I appreciate the very gracious letter that you sent to us. It's very much appreciated by the staff.

CHAIRMAN JACKSON: It's a big deal.

COMMISSIONER McGAFFIGAN: I guess I'm still stuck on your slide 8. I'm taking you back a couple. Most of the discussion today has been about post closure issues and that's where the key technical issues are focused and all that. If Congress were to pass legislation on interim storage, the preclosure issues, transportation, et cetera, would come to the fore, I imagine. How we place to simultaneously -- it's not the law of the land and it may never be the law of the land but could we resource ourselves to deal simultaneously with everything that's involved in

licensing Yucca Mountain and everything that's involved in dealing with an interim repository at the same time, including the transportation campaign to the interim repository?

DR. PAPERIELLO: I would address that from two different viewpoints. You would have to look at the resource loading, but technically there was not going to be much difference between handling materials above the ground in some kind of central interim storage facility or as the surface activities for Yucca Mountain than there is currently for

NIFSI and we have developed a standard review plan for that

and we use it for, you know, the independent spent fuel storage installations that we currently license.

So, you know, we have a lot of experience in handling spent fuel above the ground. So, I really don't really think that that would be all that difficult to do, and we would -- I would take the existing procedures and expand them. Now, who would do the review and things like that, I might have to start jiggling resources around on that, but it's not -- it's a -- I have not been as concerned with that part of a standard review plan for Yucca Mountain because I've told people we're getting a lot of experience in licensing above ground storage --

CHAIRMAN JACKSON: What about the transportation

issues?

DR. PAPERIELLO: The transportation we currently license. The question would come in, and we have raised this and this has sort of been the backwater of the budget, is will we be expected to, say, upgrade the modal studies and EIS's and that question's been raised, versus we know how to transport fuel, but is it relevant if we had many, many more packages on the road, are the existing EIS acceptable? Those questions currently due to budget constraints, these are the sort of projects that get put on the back burners, but you kind of know the questions that might be asked.

CHAIRMAN JACKSON: Do you consider that kind of issue within the context of an EIS, vis-a-vis Yucca Mountain? In the first place, you've still got to get the fuel to the site.

DR. PAPERIELLO: It would seem to me that an EIS for Yucca Mountain in part would have to consider the transportation component, yes, as well as the safety above the ground as well as the --

CHAIRMAN JACKSON: No, I'm saying, but what you've spoken to in terms of our own experience has to do with safety above the ground?

DR. PAPERIELLO: Right.

CHAIRMAN JACKSON: And the issue then becomes, the

Commissioner raised, is you have the transportation piece of a campaign to get it to that site, the I'm asking, don't you have to deal with the transportation piece to get the fuel to Yucca Mountain period, even if you were just --

DR. PAPERIELLO: That's exactly right. It's not sort of --

MR. THOMPSON: And it would be covered in the DOE EIS. It's a significant element, and you may remember early on when we were doing the LSS. That was one of the issues, were we going to have the transportation material put in there. I think the Commission agreed that that would be included in the information that's available early on.

CHAIRMAN JACKSON: Okay. Where are we, slide 11 now?

MR. BELL: Yes. Slide 11. The Commission may recognize this slide. It was an attachment to the strategy paper. Basically what we're trying to illustrate here is the framework we're using for developing our part 63 regulation with an overall performance standard that currently using the Commission guidance but might eventually be replaced by an EPA standard.

At the middle two levels are the areas that would be covered by the rule itself, but we would not have quantitative subsystem performance objectives, essentially

just requirements. These parts of the total system would

need to be evaluated and shown that they contribute to performance.

Then the lowest level is where most of the technical details is covered in the KTI's and the sub-issues is involved. This is in the regulatory guidance space. It would be initially in IRSR's an eventually in the Center.

CHAIRMAN JACKSON: In terms of the components of the subsystem, would any of them change or, you know --

MR. BELL: Change in what sense?

CHAIRMAN JACKSON: According to what the actual EPA standard might be?

MR. BELL: Basically in the systems approach that we're adopting in part 63, that's flexibility that's left through the department to determine how much weight to put on each part of the system, but then provide a convincing argument to the Commission that the total system performance standard.

MR. GREEVES: I think the question is would any of this change depending on how an EPA standard came out, and I think the answer is no. You have to visit all these things.

MR. BELL: Right, that's right.

MR. GREEVES: When we developed the KTI's a couple of years ago, it's basically an international look. What is everybody looking at? Not everybody is looking at vulcanism, so that may be one that's unique to us. You have

to visit all these things if you're looking at deep geologic burial for material that has a long line time hazard. So, I don't think anything would change with a different EPA --

CHAIRMAN JACKSON: Right, the relative weight --

MR. GREEVES: You still have --

CHAIRMAN JACKSON: -- change, but not the components themselves.

MR. GREEVES: Yes.

MR. BELL: Slide 12. This is the listing of the 10 key technical issues. I'd just like to make two points with respect to this slide. One is that based on change in the DOE program and in our own technical work, the sensitivity analyses and such that we do with our TVA code. We reprioritize these from year to year. You will see things like igneous activity that because of the large uncertainty when we began our work was considered high. Because of the progress that's been made, it's now considered a lower priority.

On the other hand, a couple of areas like container life and source term, one of the ones that was zeroed out as well as radionucleide transport, have increased in importance because of the information that's been learned by DOE about increased infiltration at Yucca Mountain. They're placing more reliance both on the package design and chemical retardation.

CHAIRMAN JACKSON: This actually does go back to my earlier question to some extent, but in a more expanded way, and that is that you develop an information base. In each of these areas there are some issues that you look to have resolution on, et cetera, but to a certain extent, what defined resolution and how much information you may require strikes me is, to some extent, modulated by the standard that you have to work to because it says something about, you know, the relative contributions of these various pieces

and how much you have to know about them in order to make a judgment about the relative contribution. So, that's really why I asked the question, not that the areas themselves would ever -- that you haven't covered the water or that everyone wouldn't have to cover these issues.

MR. PATRICK: Right.

CHAIRMAN JACKSON: But the question is the degree of resolution which -- and the degree of information for resolution to me, has to be affected by what the government standard is.

MR. PATRICK: Yeah, I would say that's true to the extent that, depending on what the dose, you know, assuming a dose standard, depending on what the dose is, you may need more help from certain phenomena.

CHAIRMAN JACKSON: That's exactly the point, and you have to know how much help you can get from certain

phenomena.

MR. PATRICK: You have to understand it better.

CHAIRMAN JACKSON: Correct.

MR. GREEVES: Another example is groundwater. If there's a groundwater standard that's very prescriptive, then the characterization effort on DOE's part --

CHAIRMAN JACKSON: Correct.

MR. GREEVES: -- correct me if I'm wrong, is significantly increased. That's part of what the issues are that are still being discussed.

CHAIRMAN JACKSON: Right.

COMMISSIONER DIAZ: I'm looking at the table and remember what the staff requested on secy 98-168. I guess the idea was to use the key technical issues to reduce the number of issues that we're going to be looking at rulemaking, to simplify rulemaking and how is that process working.

MR. BELL: The staff's current program is basically, we would go as far with issue resolution at the staff level as can be done. Always means that by the time you get to the licensing board, issues can be reopened and that one way that some of the concerns have been raised by the Senate subcommittee could be addressed would be to try to resolve some contentious issues through additional rulemaking, and basically, this would be a policy change for

the Commission that we were asking them to consider that -- one way that in this program that we're considering.

Now, we're aware that the Commission is having the general counsel consider the hearing process generally for the agency, and so it's --

CHAIRMAN JACKSON: I think as a matter of law, this one is a little more locked in in terms of what kind of process is adjudicatory.

MR. THOMPSON: And we're looking at those and when we find one that we believe it has the technical basis to go forward to the rulemaking we'll, you know, if you agree, we will then propose that to the Commission and go into rulemaking. Obviously it's the timing, but obviously we have to have the technical basis to do that.

CHAIRMAN JACKSON: Absolutely. Otherwise it will be challenged in the law.

MR. THOMPSON: That's right.

CHAIRMAN JACKSON: But what I'm saying is the flexibility in this area may not be as great.

MR. BELL: Okay, now at this point I would like to turn to Wes to ask him to give the Commission some technical

background on some of the work that's been done on issue resolution.

MR. PATRICK: And see how I can do in the next three minutes. If I start sounding like an auctioneer on

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these, slow me down.

CHAIRMAN JACKSON: We'll give you 21 minutes. There's 21 minutes for seven areas. That's three apiece.

[Laughter.]

And then we'll eat and shut everybody else up.

MR. PATRICK: Each of the ten key technical issues that you just looked at on slide 12 have been segmented into a series of sub-issues. These are bite-sized pieces that are amenable to being addressed in sufficient technical detail that we can actually resolve them at the staff level working with the department of energy.

The number of sub-issues in each KTI varies, but in each case, they're focused on a logical path that will lead to closure, first of the sub-issues and then of the issues overall.

Slide 13 shows the seven sub-issues that to date we have resolved at the staff level. In all cases, the staff has used a combination of information that's generally available out in the literature. Site specific and design specific information we've obtained from the Department of Energy studies. Our own, and by our own I mean the staff and NRC staff and Center staff studies in focused areas, as well as directed interactions between the staff and the Department of Energy to achieve resolution at the staff level.

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Each of those --

COMMISSIONER McGAFFIGAN: Could you give me the total number of sub-issues? You know, you have nine key technical issues that are truly technical.

MR. PATRICK: It's on the neighborhood of 25, 28. I suppose by the time we work our way through these three slides, I could do a tally of them. I think there are seven of these, eight that fall into a middle category and nine or ten that we've judged to be more difficult to resolve.

With that as an introduction, I would comment that what I want to do in the next series of slides is talk about these sub-issues in three groups, those -- and shown here on 13 are those that we've already resolved at the staff level. A second set are ones that we consider to be nearing resolution, and by nearing, we would consider that to be within the next year or two we would be able to close those barring any unforeseen new information or upsets in resources available. The third set are ones that we find to be particularly difficult to address. For each of those groupings, I'll give a specific example to give you a sense of the level of the technical analysis that your staff and mine are putting into resolving these issues so that there will be a solid technical basis as we go forward into the VA and into the suitability determination and finally, into the licensing action itself.

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I started to say that each of these items, and this is true of all three groups, the progress is being documented in the issue resolution status reports, and in some cases, and on this particular slide, the third to the last bullet, the use of expert elicitation. We actually went to a formal staff technical position there to be able to

nail that down. Commissioner, it's short of a rulemaking, but it carries more weight than a NUREG report, which is the form that the IRSR's take.

Slide 14 is the example we've chosen for this particular category where we're examining the sub-issue dealing with the probability of vulcanism. This is the first piece of analyzing the risk. This is a probability piece. The second piece that I'll touch on just briefly later is the consequence component of igneous activity. Our interest here was generated by the fact that Yucca Mountain is located in a geologically active area, an area where there's been recent vulcanism. There are cinder cones that mark the topography. I think you've all been out there and stood on the top and seen those. There are a number of others that are buried beneath the alluvial cover in that area.

COMMISSIONER DIAZ: Is this recent?

MR. PATRICK: Geologically recent. The youngest one is a little older than I am. I think it's one the order

of one to 200,000 years old, but it's in that range. Yes, I should -- for non-geoscientists, certainly geological is an appropriate caveat.

The concern here is with the potential of direct disruption of the repository by magma that may ascend from depth up through the repository entraining waste in the magma and then dispersing it to the surrounding area.

CHAIRMAN JACKSON: Does that also consider what would happen once the repository is backfilled?

MR. PATRICK: The presence of backfill, as it turns out from our initial consequence analyses, the presence or absence of backfill could be a key factor in the extent of the consequences, and that's one that we're looking at very decisively over the next year or so as we examine consequences because that is, as it turns out, a key factor.

You'll note here that we've done sufficient work that we now believe we have bound to the probability of eruption and direct disruption of the repository at ten to the minus seven per year, one in ten million per year. DOE has also gone through a process of trying to bound the probability. Their process relied heavily on the elicitation of expert judgments, and they have come up with a range where their mean value is somewhat lower than ten to the minus seven, but if you consider their entire

distribution, their range of probabilities encompasses the NRC's Center value as well.

Now, there's a caveat here and this is one of the ongoing activities of the Center. Even though an issue may be closed at the staff level, we continue to gain information as DOE continues site characterization as other researchers do work in related areas, and we have had such a case arise here this year where -- and I think many of you are aware of it. Dr. Warneke from CalTech and his colleagues have completed some tressle strain measurements that indicate that tressle strain and by implication the probability of vulcanism and seismicity, direct fault disruption and a variety of other factors that we're interested in, could be as much as an order of magnitude, a factor of ten, higher than what we considered in our analyses.

We've made a very quick adjustment in the program for us to go back and review and analyze Warneke's work. We

brought in some outside experts in strain measurements, GPS technology, to be able to bolster the work that we were doing ourselves, and we've made some appropriate changes in the priorities so that we can re-examine this particular aspect of the probability piece of the puzzle.

Slide 15 gives pictorially the results of one of many models that we have used in trying to understand and

evaluate the potential for renewed vulcanism at the site. This is a model which considers data from the occurrence of volcanoes over the last two million years, geologically the quaternary period. It also includes the effects of structural geology in the area, including structures such as the Bear Mountain fault, which is west of this site and the Amargosa Trough which is just east of the site.

Those geological features become important because they do affect the probability, and they also affect gradients, and you'll notice by the color coding here, and each of those numbers, by the way, has a ten to the minus four behind it, and the number refers to the estimated or calculated number of volcanoes that would occur per square kilometer during the compliance period.

The thing that I'd like to point out here is how steep the gradients are, and those are an indication both of the uncertainty with regard to predicting the recurrence of vulcanism, and also an indicator of how spatially, how quickly spatially those estimates change as one moves outward from the known -- currently known volcanic Centers.

The second grouping of sub-issues are those that are nearing resolution at this time. There are six of them indicated here on this chart. These are ones that tend to be more difficult to address for several reasons. Two key reasons are particularly noteworthy. First, these are areas

where the knowledge base is -- that's available in the open literature and in laboratory reports and the like is less fully developed. They are areas that typically are at the edge of interest for the general technical community. They're peculiar to high-level waste management, and consequently there's not a large database and information base developed at this time.

Second, they tend to be more complex. Almost without exception, they involve multiple processes, multiple physical processes and consequently, we have to bring to bear multiple technical expertise to be able to address and attempt to resolve these particular sub-issues. I want to take as an example the first bullet there, deep percolation, and before jumping into the discussion on it in particular, I want to give a little bit of background on one of the sub-issues that is resolved because it feeds directly into it, that's namely the rate of shallow infiltration.

By shallow infiltration, we mean the movement of water down below the root zone where it's no longer available for either evaporation or uptake by plants and transpiration back into the environment. This is an area where we have found it necessary to do some of our own work. In fact, some of our own field work as well as model development and calculations to be able to convince ourselves of the depth, the extent of shallow infiltration.

It's an area of considerable controversy early on with the Department of Energy, and it took some time and some effort on both our parts and also they and their contractors' parts

to be able to convince ourselves that the rate of infiltration was substantially higher than what was originally used in the Department of Energy's estimates.

Why do we care about this? Shallow infiltration is what is feeding water into the repository. It is the upper bounding condition, if you will, on what eventually becomes deep percolation, which moves down into the repository horizon, eventually wets the containers, leads to their corrosion, and would transport waste from the repository level down to the saturated zone and from there out to the accessible environment. So, it's a critical area. It's an area which has been uniformly been found to be important in the Department of Energy, NRC, EPRI and just about anybody else's calculation that has been done in this particular area.

I'd point out the second and third bullets are areas which complicate our understanding and the work related to deep percolation, the presence of faults and fractures. It's a geologically quite complex site, so that's an area of emphasis that we're giving considerable attention to.

The second one there indicated in the third bullet

of slide 17 is also one that is of great interest to us, and I'll come back and touch on that in just a moment because this concept of lateral diversion of flow at stratigraphic boundaries and mineralogically altered zones is a key aspect of the Department of Energy's safety case that they're current working on.

If we could turn to slide 18 shown here in graphical display as this shallow infiltration that I spoke of earlier, the color bar at the bottom shows the mean annual infiltration that we calculated to occur.

COMMISSIONER DIAZ: I wanted to know if the Commission is not capable of seeing the colors of this.

MR. PATRICK: I was going to say, I apologize for that. Is everybody all set?

You'll note on that side bar that we run from the dark blue showing a low of no mean annual infiltration up to a high of about 60 millimeters per year, and the key thing to note on this figure is where most of the highs in infiltration are occurring, and they're occurring along ridgetops and in deeply incised canyons where there's relatively little soil cover. We've gone out into the field and done sufficient investigations that we've been able to verify at a preliminary level the accuracy of this model that we've developed, and that's crucial. Interestingly, the geological survey has done a series of bore hole

measurements out there, and they've been able, using neutron probe techniques to get measurements that we've been able to come back, compare with the results that we have and are finding quite good agreement. So, those kinds of independent arrivals at information using modeling, using field measurements, have been very helpful in resolving particularly difficult issues such as this.

I would point out another thing here that not in all cases -- in fact, in relatively few cases is this depth of analysis needed, but this is really the only way that the staff is able to have both confidence in the ultimate results that are going to be brought forward to you as a result of our reviews and at the same time to avoid undue conservatisms. You can be confident with a highly conservative result, but to back off on that conservatism,

it takes additional knowledge, additional insight, additional calculational and measurement results, and this is an example where we brought those to bear to avoid undue conservatism.

Slide 19 is really a conceptualization, a cartoon if you will, moving from shallow infiltration down into the realm of deep percolation. The influence of fractures and faults, I indicated early, are central considerations here. The Department of Energy is currently considering that these stratigraphic boundaries that you could -- let's see, if

everybody has a color one there, the dark brownish, reddish brown color, would be one of those stratigraphic horizons and shown conceptually as the diversion of water that has moved down through the shallow infiltration area and is now hypothesized to be carried off east of the site and hence not be moving down into the region of the repository.

We are using data that has been collected from a variety of open literature sources as well as recently, we have obtained a copy of DOE's geological information system that has tremendous wealth of information regarding the structural geology of that site as well as a variety of soil properties, chemical and hydrological properties, we're using those in our own evaluations and our own studies this year with regard to depercolation. Again, just to emphasize the importance of understanding what proportion of the water eventually makes it down to the repository.

Slides 20 indicates those issues that we found to be particularly difficult to address, as with the preceding category, these sub-issues are characterizes as having a knowledge base that's less complete, and also the issue being more complex in the sense that it uses a variety of technical disciplines. We anticipate, not at all surprised, that these are going to take more total time and more resources to be able to resolve than some of the other issues that we've been talking about.

A key point, thought, not to be, you know, discouraged about those words, a key point is that we will have in place the most current information in the form of revision two of the issue resolution status reports for all of these ten issues -- nine of the ten issues rather, then tenth not having one, and we'll have commentary on each of these sub-issues before the license application comes in. So, the most current information will be available to the Department of Energy and they'll be able to consider that as they move forward.

COMMISSIONER McGAFFIGAN: You used the time frame for the previous set of issues of one to two years to resolve the ones that were nearing resolution. Do you want to put a time frame on resolving these, or are these going to realistically only be resolved while we're dealing with the license application?

MR. PATRICK: We will -- perhaps position is too strong of a word but I can't think of a better one right now. We will have taken a position with regard to establishing acceptance criteria in review methods in the IRSR's for each one of these before the LA comes in, and all of that will be rolled up into the Yucca Mountain review plan. So, DOE will have that approximately a year before the LA. That suggests that we'll have at least partial resolution on all of these within the next three years or

so, but I fully anticipate that some of these we will go into the LA with the sub-issues unresolved. Some -- and it's a little bit speculative, but some may become license conditions, that DOE will be expected to do follow-on work through the performance confirmation period which is established by current regulation and we would anticipate being an element of Part 63, that that would be the way to address some of the particularly difficult issues where either insufficient knowledge was available about the design and the performance of that design, or there remain some uncertainties about complex site issues that were not adequately resolved at that time. I mean, I'm speaking in a little bit regulatory space here. I don't know whether John or someone else --

MR. GREEVES: I think the most difficult one is recognized internationally, is the coupling issue, and I think they've got a world class facility out there that I think most of you have been out to see, but it takes literally years for that information to come forward and to use the codes that either we or DOE has to understand how that gets confirmed over time, so there's going to be, I think, some issues out there. The legislation built in an approach and the regulation built in an approach for performance confirmation to play a role in this unique repository effort.

MR. PATRICK: Let me hit on this last area on Slide 21 quickly, given that time is slipping away on us here. We view among the most complex of the issues as being prediction of waste package lifetime. We made a determination early on that to predict waste package lifetime, we had to go considerably beyond the normal routine testing where one tests for a period of time and draws curves and projects out, that a more mechanistic understanding would be required. We set about doing that in the early days of the program, and that's what's indicated here. We developed a predictive approach for assessing localized corrosion and the corrosion resistant alloys. Some of that early work, coincidentally, involved C-22, although most of it, which is DOE's most recent allow, although most of the work focused on other alloys such as Alloy 825 and some work with 625.

We have been very sensitive to changes in DOE's mix of allows that they have under consideration. We have flexibly moved to consider those changes. One of the things that we've done, having a smaller program, you have to be particularly clever in how you approach things. We have tried to identify classes of allows and did that early on beginning about eight or nine years ago, and by having testing done in each of broad classes of alloys, we've been able to be quite adroit at moving to new specific alloys and

augmenting the database that is available.

If we could take a look at Slide 22, I can show you graphically the sort of way that we approach things in a more mechanistic sense. We've used a repassivation potential approach here to try to understand the range of conditions under which corrosion occurs and corrosion resistant materials. Think of that vertical axis, the one label crevice repassivation potential as a measure of the oxidizing capacity of the environment. The horizontal axis, the chloride concentration, as a measure of the salinity of the environment. So, we have a couple of environmental parameters here. We can do testing in the laboratory for

range of materials and make a determination as to the conditions under which corrosion might occur.

The other thing to note here is the shaded area which is our current best understanding using modeling and measurements and DOE data, our current best understanding of the range of those conditions that could occur at Yucca Mountain. Recognizing that corrosion occurs to the right of these lines, if one starts across at around, just to pick a number, somewhere in the neighborhood of zero -- it's an easy one to pick up on -- you'll notice that this says that alloy 825 is quite corrosion resistant, under these conditions, up to a chloride level of about .01. After that, it begins to pit and corrode. 625 Is significantly

better than that. It will take about an order of magnitude higher chloride concentration.

The really interesting one is the bar across the top, which is the latest DOE alloy to come forward, C-22. Now, that looks like we're home free, but there is some information out in the literature with regard to both stress corrosion cracking of this allow and also with respect to pitting when there are ferric ions present in the groundwater or the environmental waters that it's exposed to. Those two things need to be studies, and we're focusing on those this year. They're part of the operations plan for work, but those suggest that chloride could -- that crevice attack or pitting attack or stress corrosion attack could occur at substantially lower values. So, we're going to be paying considerable attention to that.

COMMISSIONER DIAZ: Excuse me, just as a technical note.

MR. PATRICK: Yes.

COMMISSIONER DIAZ: It just occurred to me that you might be considering whether DOE is going to put anything in their repository, whenever and if it happens that contains fluorine.

MR. PATRICK: Okay. We've not examined it from a human introduced product, but interestingly, one of the secondary effects of vulcanism is that there's often

chlorine gas that evolves as vulcanism takes place. So, we've looked at it just briefly from that perspective.

COMMISSIONER DIAZ: And anything that contains UF6 we might not want to have --

MR. PATRICK: As an alternative waste form in there, or an additional waste form.

Just to wrap up that part of the discussion then, I did want to -- and it's an item that's mentioned on a previous viewgraph, there are a number of what we view to be crucial uncertainties regarding waste package lifetime at this point, and we're going to be evaluating those, both using their sensitivity studies, using the total system performance assessment code which will enable us to understand how sensitive performance is for these particular parameters, as well as more detailed calculational studies and some selected laboratory studies to examine whether some of these phenomena that I've alluded to are truly going to be important for a Yucca Mountain environment.

MR. BELL: We're past 3:30. If the Commission wants to continue, I just have a few points I'd like to make about the viability assessment and then wrap up.

CHAIRMAN JACKSON: I think we want you to continue.

MR. BELL: The viability assessment as required by the DOE's appropriation bill has four parts to it, a

conceptual design, a total system performance assessment, a license application plant and then a cost estimate.

The NRC staff has been interacting extensively with the department on the conceptual design and total system performance assessment. The results of those interactions have been reflected in the issue resolution status reports we've developed in those areas.

We have not at this point had the opportunity to interact with the department on their license application plan, even though that's an area that we're particularly interested in, finding out what they perceive is the work that still needs to be done to develop the license application and to see whether, in fact, they are intending to address all the things the staff considers might be necessary. We would not -- an interaction like that is planned for the mid-September time frame. We would not particularly pay attention to the cost estimate part of the review.

On site 24, basically we want to use the VA as an opportunity to see where DOE stands in making progress towards the license application. It will be an opportunity to point out potential licensing vulnerabilities. In fact, as the result of the interactions we've already had on their total system performance assessment, we sent a letter this July pointing out some places where we thought they either

had assumptions or conceptual models that weren't adequately supported by data and such that ought to be factored into their license application plan, but we have not had the opportunity to see whether, in fact, they've taken that into consideration.

Since it's not a regulatory document, you know, our focus on the review of the VA is really to use it to help us to get prepared for licensing, and we would do our review by focusing on the key technical issues for post closure performance and the acceptance criteria in our IRSR's.

We would not particularly focus on pre-closure activities because we don't think they're going to be make or break issues for the viability of the repository.

Our review would consist of two parts. Any major issues we would put in a paper that we would send up to the Commission that the Commission could then be prepared if asked to respond to Congress with its concerns or issues regarding the viability assessment. Things at the more detailed technical level would essentially be just factored into the ongoing technical work and issue resolution.

Did I mention that the staff plans, and I think there's actually a chairman's tracking item, that the paper with any major issues would be to the Commission within three months after the liability assessment is published.

So, to sum up, the program during fiscal '98 has, in fact, recovered from the budget reductions of '96 and '97. We're now working in all areas. We're making progress in issue resolution in all of the key technical issues for post-closure performance, and we'll have guidance available for the department in all nine areas by the time that the viability assessment.

We made progress on the development of our risk and performance based regulation for the repository part 63,

and the Commission is scheduled to receive that at the end of the fiscal year. Through the issue resolution process we put in place, we've been making progress, and we are developing and implementing our performance assessment capabilities and program to accomplish the Commission's goal.

CHAIRMAN JACKSON: Thank you. Commissioner Diaz?

Well, let me thank you on behalf of the Commission, Dr. Patrick, and all the members of the NRC staff for a very informative briefing. The information you've provided to us, you know, helps to mature the Commission's perspective on all of these issues on the NRC's high-level waste program and the challenges that it still faces. So, we commend you and the Center, the staff and the Center for working through the issues and developing a credible program under sometimes trying circumstances.

The Commission needs you to keep us informed of the progress, to surface the issues in a timely way, and we look forward to future briefings which may end up picking up in pace as we get into a season where we know there are some specific products that we have to consider.

Again, thank you for coming from Texas, and stay away from the hurricane. So, unless there are further comments, we are adjourned.

[Whereupon, at 3:30 p.m., the briefing was concluded.]