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NUCLEAR REGULATORY COMMISSION

Title: BRIEFING ON STATUS OF ACTIVITIES WITH
CNWRA AND HLW PROGRAM
PUBLIC MEETING

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1025 Connecticut Avenue, NW, Suite 1014
Washington, D.C. 20036
(202) 842-0034

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1 UNITED STATES OF AMERICA
2 NUCLEAR REGULATORY COMMISSION

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4 BRIEFING ON
5 STATUS OF ACTIVITIES WITH CNWRA
6 AND HLW PROGRAM

7 ***

8 PUBLIC MEETING

9 ***

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11 Nuclear Regulatory Commission
12 One White Flint North
13 11555 Rockville Pike
14 Commissioners' Conference Room
15 Rockville, Maryland
16 Wednesday, August 26, 1998

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

20 COMMISSIONERS PRESENT:

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

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1 STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

2 JOHN C. HOYLE, SECRETARY OF THE COMMISSION

3 KAREN CYR, GENERAL COUNSEL

4 HUGH THOMPSON, EDO

5 CARL PAPERIELLO, NMSS

6 JOHN GREEVES, NMSS

7 WESLEY PATRICK, CNWRA

8 MICHAEL BELL, NMSS

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P R O C E E D I N G S

[2:08 p.m.]

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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.

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

10 So with that, Mike?

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

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

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

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

1 little bit about how it's organized.

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

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

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

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

17 On slide 4, --

18 CHAIRMAN JACKSON: You didn't mean for disposal of
19 waste at Yucca Mountain; you mean for the work related to --
20 that we have to do under the law vis-a-vis the assessment of
21 Yucca Mountain and our various pre-licensing and licensing
22 activity? Presuppose the judgment if you took it at its
23 face value.

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

1 MR. THOMPSON: That's correct.

2 CHAIRMAN JACKSON: That's right.

3 MR. BELL: Okay. Absolutely.

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

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

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

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

24 As I mentioned earlier, in --

25 COMMISSIONER McGAFFIGAN: Could I just ask a

1 question on that point? We had a meeting yesterday -- Carl
2 was here -- and we talked about the advantages of the Part
3 35 approach to rulemaking that -- where we had draft rules
4 out on the Web before the proposed rule came to us, and some
5 significant discussion of issues occurred prior to the rule
6 coming to us.

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

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

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

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

25 Yes?

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

3 CHAIRMAN JACKSON: Yes.

4 MR. BELL: -- a proposed rule would be put on the
5 Web page --

6 CHAIRMAN JACKSON: The Web.

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

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

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

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

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

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

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

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

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

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

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

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

1 it now or take it up in turn.

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

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

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

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

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

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

20 MR. BELL: That's right.

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

23 MR. THOMPSON: Right.

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

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

3 CHAIRMAN JACKSON: Okay.

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

6 CHAIRMAN JACKSON: Okay.

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

8 CHAIRMAN JACKSON: Okay.

9 Yes, Commissioner.

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

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

16 COMMISSIONER McGAFFIGAN: Okay.

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

19 COMMISSIONER McGAFFIGAN: But for the other nine?

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

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

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

2 MR. BELL: No.

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

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

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

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

13 MR. THOMPSON: This dialogue --

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

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

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

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

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

1 CHAIRMAN JACKSON: They're involved and aware.

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

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

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

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

20 MR. BELL: Yes. There was a public meeting the
21 15th of May that -- we took advantage of an opportunity.
22 Since we were in Las Vegas for the high-level waste
23 conference that one evening, we held a public meeting. But
24 it did not really focus on Part 63; it was more the program,
25 what's NRC's role, how we interact with DOE in this

1 prelicensing consultation.

2 CHAIRMAN JACKSON: Commissioner?

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

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

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

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

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

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

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

12 MR. BELL: That's right. And there has been --
13 one example, the KTI dealing with seismicity, in that case,
14 the state actually had its own experts with their own
15 seismic models, and they made presentations to the NRC and
16 DOE staff that were taken into account when we developed our
17 issue resolution status report.

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

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

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

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

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

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

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

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

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

10 CHAIRMAN JACKSON: Yes, Commissioner Diaz and
11 Commissioner McGaffigan.

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

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

24 This is the kind of information we're sharing with
25 the staff of the EPA, like the -- I mean, types of

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

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

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

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

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

21 DR. GREEVES: We're communicating.

22 COMMISSIONER DIAZ: All right.

23 [Laughter.]

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

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

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

8 CHAIRMAN JACKSON: Okay.

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

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

18 COMMISSIONER McGAFFIGAN: But is DOE --

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

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

1 would be a little hard.

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

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

10 COMMISSIONER McGAFFIGAN: I understand.

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

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

23 MR. BELL: Right.

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

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

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

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

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

23 MR. BELL: That's right.

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

1 --

2 CHAIRMAN JACKSON: Right.

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

4 CHAIRMAN JACKSON: I think it is important for us
5 to understand and for the Commission to understand, you
6 know, and if you're not totally sure, then maybe you can
7 kind of get the answer to, you know, what is DOE using for
8 its viability assessment, I think we know what you're using
9 --

10 DR. GREEVES: Right.

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

20 MR. BELL: That's right.

21 CHAIRMAN JACKSON: Right. Okay.

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

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

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

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

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

25 MR. BELL: Do you mean EPA?

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

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

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

10 MR. BELL: Yes. Actually --

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

13 MR. BELL: The --

14 CHAIRMAN JACKSON: -- to comment on.

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

17 THE COURT: Commission's --

18 MR. BELL: Sufficiency comments.

19 CHAIRMAN JACKSON: Sufficiency comments.

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

23 THE COURT: Okay.

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

1 the design work that's been done, so that basically these
2 interactions of DOE take place in the year 2000, 2001.
3 There is -- the line above it, though, is important
4 groundwork for that. The way we see that taking place is
5 that the department actually plans to submit to us a working
6 draft of a license application later in fiscal '99 that the
7 staff would review essentially for completeness, like an
8 acceptance review, give comments back to the department on
9 where the work was still deficient so that they essentially
10 would know two years before the license application was to
11 be submitted what still had to be done.

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

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

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

1 and --

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

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

9 CHAIRMAN JACKSON: Okay, right.

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

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

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

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

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

6 MR. BELL: Yeah --

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

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

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

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

18 CHAIRMAN JACKSON: Sure. Okay, Commissioner?

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

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

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

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

17 CHAIRMAN JACKSON: Okay.

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

1 staff's thinking is.

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

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

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

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

1 considered in all of those issue resolutions, and that comes
2 back to the point of we're looking at everything we can get
3 our hands on in preparation for the VA coming out this fall
4 and we'll continue that process all the way through the site
5 suitability process and eventually the license application.

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

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

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

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

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

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

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

14 COMMISSIONER MCGAFFIGAN: -- gets stretched out
15 even further.

16 MR. BELL: Other things will be impacted.

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

24 CHAIRMAN JACKSON: Maybe a digital process.

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

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

5 CHAIRMAN JACKSON: Dr. Paperiello?

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

13 Secondly, the viability assessment that we owe
14 you, and thirdly, the waste confidence paper that is also
15 due the end of next year. So, for over the next year, those
16 things I think are the critical paths.

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

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

8 CHAIRMAN JACKSON: Where is the waste confidence
9 on this?

10 DR. PAPERIELLO: The last slide.

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

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

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

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

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

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

13 MR. THOMPSON: Right.

14 CHAIRMAN JACKSON: It begins to be relevant.

15 MR. THOMPSON: Exactly.

16 CHAIRMAN JACKSON: Okay.

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

1 involved, Wes, the president of the Center, and Booty Sager,
2 the technical director of the Center, have weekly conference
3 calls where we do planning, set priorities, develop many of
4 the budget and programmatic documents for the program.

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

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

14 MR. BELL: With the NRC high-level waste program.
15 Within the Center staff, 98 percent have graduate degrees,
16 67 percent are PhD's. The Center and the NRC staff both
17 take part in international activities, including things like
18 peer reviews of high-level waste programs in other
19 countries. In fact, just today we learned that Booty Sager,
20 the technical director of the Center, has been invited by
21 the IAEA to advise the Brazilian government on its
22 performance assessment model.

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

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

3 The Commission, I think, is aware that R&D
4 magazine recently recognized the Center for its work on the
5 3D stress code with an R&D 100 Award. Basically, that's an
6 award that's given annually by that magazine for the 100
7 most technically significant innovations in the country.
8 It's an award that's coveted by universities, industry,
9 national laboratories, and we think it's an example of the
10 kind of high quality work that the --

11 CHAIRMAN JACKSON: I'm familiar with it.

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

15 CHAIRMAN JACKSON: It's a big deal.

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

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

5 DR. PAPERIELLO: I would address that from two
6 different viewpoints. You would have to look at the
7 resource loading, but technically there was not going to be
8 much difference between handling materials above the ground
9 in some kind of central interim storage facility or as the
10 surface activities for Yucca Mountain than there is
11 currently for
12 NIFSI and we have developed a standard review plan for that
13 and we use it for, you know, the independent spent fuel
14 storage installations that we currently license.

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

25 CHAIRMAN JACKSON: What about the transportation

1 issues?

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

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

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

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

24 DR. PAPERIELLO: Right.

25 CHAIRMAN JACKSON: And the issue then becomes, the

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

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

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

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

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

22 At the middle two levels are the areas that would
23 be covered by the rule itself, but we would not have
24 quantitative subsystem performance objectives, essentially
25 just requirements. These parts of the total system would

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

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

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

9 MR. BELL: Change in what sense?

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

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

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

21 MR. BELL: Right, that's right.

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

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

4 CHAIRMAN JACKSON: Right, the relative weight --

5 MR. GREEVES: You still have --

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

8 MR. GREEVES: Yes.

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

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

1 CHAIRMAN JACKSON: This actually does go back to
2 my earlier question to some extent, but in a more expanded
3 way, and that is that you develop an information base. In
4 each of these areas there are some issues that you look to
5 have resolution on, et cetera, but to a certain extent, what
6 defined resolution and how much information you may require
7 strikes me is, to some extent, modulated by the standard
8 that you have to work to because it says something about,
9 you know, the relative contributions of these various pieces
10 and how much you have to know about them in order to make a
11 judgment about the relative contribution. So, that's really
12 why I asked the question, not that the areas themselves
13 would ever -- that you haven't covered the water or that
14 everyone wouldn't have to cover these issues.

15 MR. PATRICK: Right.

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

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

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

1 phenomena.

2 MR. PATRICK: You have to understand it better.

3 CHAIRMAN JACKSON: Correct.

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

7 CHAIRMAN JACKSON: Correct.

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

11 CHAIRMAN JACKSON: Right.

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

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

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

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

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

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

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

17 MR. THOMPSON: That's right.

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

20 MR. BELL: Okay, now at this point I would like to
21 turn to Wes to ask him to give the Commission some technical
22 background on some of the work that's been done on issue
23 resolution.

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

1 these, slow me down.

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

4 [Laughter.]

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

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

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

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

1 Each of those --

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

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

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

1 I started to say that each of these items, and
2 this is true of all three groups, the progress is being
3 documented in the issue resolution status reports, and in
4 some cases, and on this particular slide, the third to the
5 last bullet, the use of expert elicitation. We actually went
6 to a formal staff technical position there to be able to
7 nail that down. Commissioner, it's short of a rulemaking,
8 but it carries more weight than a NUREG report, which is the
9 form that the IRSR's take.

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

23 COMMISSIONER DIAZ: Is this recent?

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

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

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

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

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

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

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

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

17 We've made a very quick adjustment in the program
18 for us to go back and review and analyze Warneke's work. We
19 brought in some outside experts in strain measurements, GPS
20 technology, to be able to bolster the work that we were
21 doing ourselves, and we've made some appropriate changes in
22 the priorities so that we can re-examine this particular
23 aspect of the probability piece of the puzzle.

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

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

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

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

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

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

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

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

1 It's an area of considerable controversy early on with the
2 Department of Energy, and it took some time and some effort
3 on both our parts and also they and their contractors' parts
4 to be able to convince ourselves that the rate of
5 infiltration was substantially higher than what was
6 originally used in the Department of Energy's estimates.

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

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

25 The second one there indicated in the third bullet

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

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

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

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

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

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

8 I would point out another thing here that not in
9 all cases -- in fact, in relatively few cases is this depth
10 of analysis needed, but this is really the only way that the
11 staff is able to have both confidence in the ultimate
12 results that are going to be brought forward to you as a
13 result of our reviews and at the same time to avoid undue
14 conservatisms. You can be confident with a highly
15 conservative result, but to back off on that conservatism,
16 it takes additional knowledge, additional insight,
17 additional calculational and measurement results, and this
18 is an example where we brought those to bear to avoid undue
19 conservatism.

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

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

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

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

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

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

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

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

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

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

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

1 augmenting the database that is available.

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

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

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

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

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

18 MR. PATRICK: Yes.

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

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

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

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

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

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

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

22 CHAIRMAN JACKSON: I think we want you to
23 continue.

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

1 conceptual design, a total system performance assessment, a
2 license application plan and then a cost estimate.

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

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

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

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

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

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

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

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

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

8 We made progress on the development of our risk
9 and performance based regulation for the repository part 63,
10 and the Commission is scheduled to receive that at the end
11 of the fiscal year. Through the issue resolution process we
12 put in place, we've been making progress, and we are
13 developing and implementing our performance assessment
14 capabilities and program to accomplish the Commission's
15 goal.

16 CHAIRMAN JACKSON: Thank you. Commissioner Diaz?

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

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

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

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

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CERTIFICATE

This is to certify that the attached description of a meeting of the U.S. Nuclear Regulatory Commission entitled:

TITLE OF MEETING: BRIEFING ON STATUS OF ACTIVITIES WITH
CNWRA AND HLW PROGRAM
PUBLIC MEETING

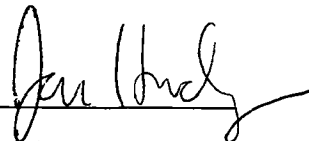
PLACE OF MEETING: Rockville, Maryland

DATE OF MEETING: Wednesday, August 26, 1998

was held as herein appears, is a true and accurate record of the meeting, and that this is the original transcript thereof taken stenographically by me, thereafter reduced to typewriting by me or under the direction of the court reporting company

Transcriber: Karen Nye

Reporter: Jon Hundley

A handwritten signature in black ink, appearing to read "Jon Hundley", is written over the printed name "Jon Hundley" in the Reporter line.



NRC HIGH-LEVEL WASTE REPOSITORY PROGRAM HIGHLIGHTS, ACCOMPLISHMENTS, AND OUTLOOK

Presented by

**Michael J. Bell
Wesley C. Patrick**

August 26, 1998

OUTLINE OF BRIEFING

- **Program Overview: Goals, Strategies, Highlights, and Objectives**
- **Program Elements, Management, and Integration**
- **Program Accomplishments and Outlook**
- **Summary and Conclusions**

GOALS

- **Ensure Treatment, Storage, and Disposal of Wastes Produced by Civilian Uses of Nuclear Material in Ways That Do Not Adversely Affect This or Future Generations**
- **Establish the Regulatory Framework for HLW Disposal, Consistent With Current National Policy, As Required By Law**

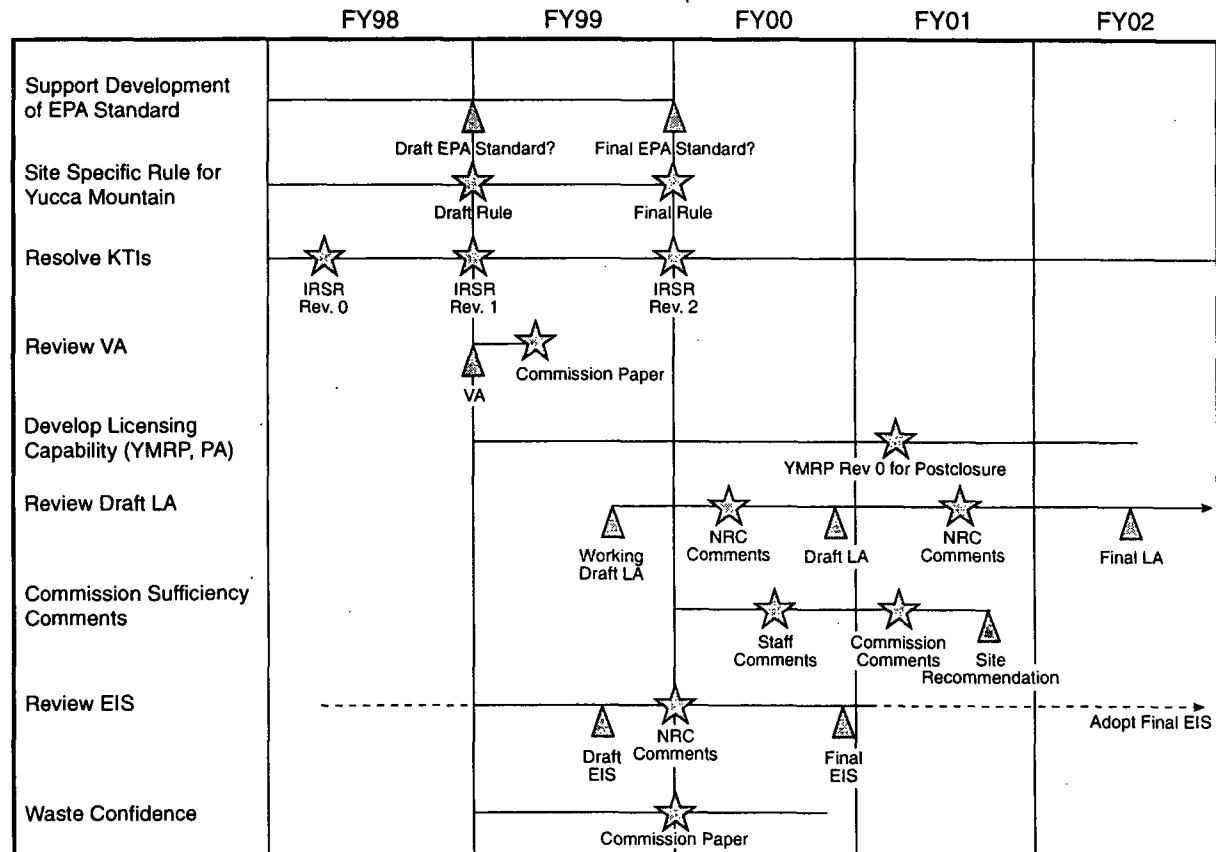
HLW PROGRAM STRATEGIES

- **Participate in Development of a Practical and Implementable HLW Radiation Safety Standard**
- **Implement the Standard Through Site-Specific Performance Based Regulation (Part 63)**
- **Resolve Key Technical Issues Most Important to Performance of a HLW Repository**
- **Provide Early Feedback to DOE Before the Viability Assessment**
- **Prepare for Licensing**
- **Provide Information and Opportunities for Interactions With the State of Nevada, Affected Units of Local Government, Indian Tribes, and the Public**

PROGRAM HIGHLIGHTS

- **Drafted Risk-Informed Performance-Based Site-Specific Repository Regulation**
- **Issue Resolution Status Reports Already Completed for 8 KTI's; Updates and One New IRSR Due Out by the End of the Fiscal Year**
- **Completed Significant Upgrade to Total-System Performance Assessment (TPA) Code; Version for Viability Assessment (VA) Review to be Completed by Year End**
- **Implemented Unique Approach to VA Review; Foundation for LA Review**
- **Conducted Public Interactions**

HLW PROGRAM SCHEDULE



★ NRC Milestone

▲ DOE or EPA Milestone

7-31-98

PRINCIPAL ELEMENTS OF THE HLW PROGRAM

- **Develop Regulatory Framework for NRC Rule**
- **Use IRSRs to Document Issue Resolution and Prepare Acceptance Criteria and Review Methods; Incorporate into the YMRP**
- **Implement TSPA Methodology and TPA Computer Code**
- **Integrate Staff Work to Assure Consistency and Cohesiveness of the Program Through LA Review**

ORGANIZATION AND INTEGRATION OF WORK IN A TOTAL SYSTEM CONTEXT

- **Focus on Issue Resolution**
- **Focus on Key Technical Issues for Post-closure Performance**
- **Use On-Site Representatives to Evaluate DOE QA Program and Monitor Site Characterization and Construction Activities**
- **Form Interdisciplinary Teams of NRC and CNWRA Staff; Augment with Consultants**
- **Provide Oversight with HLW Management Board**

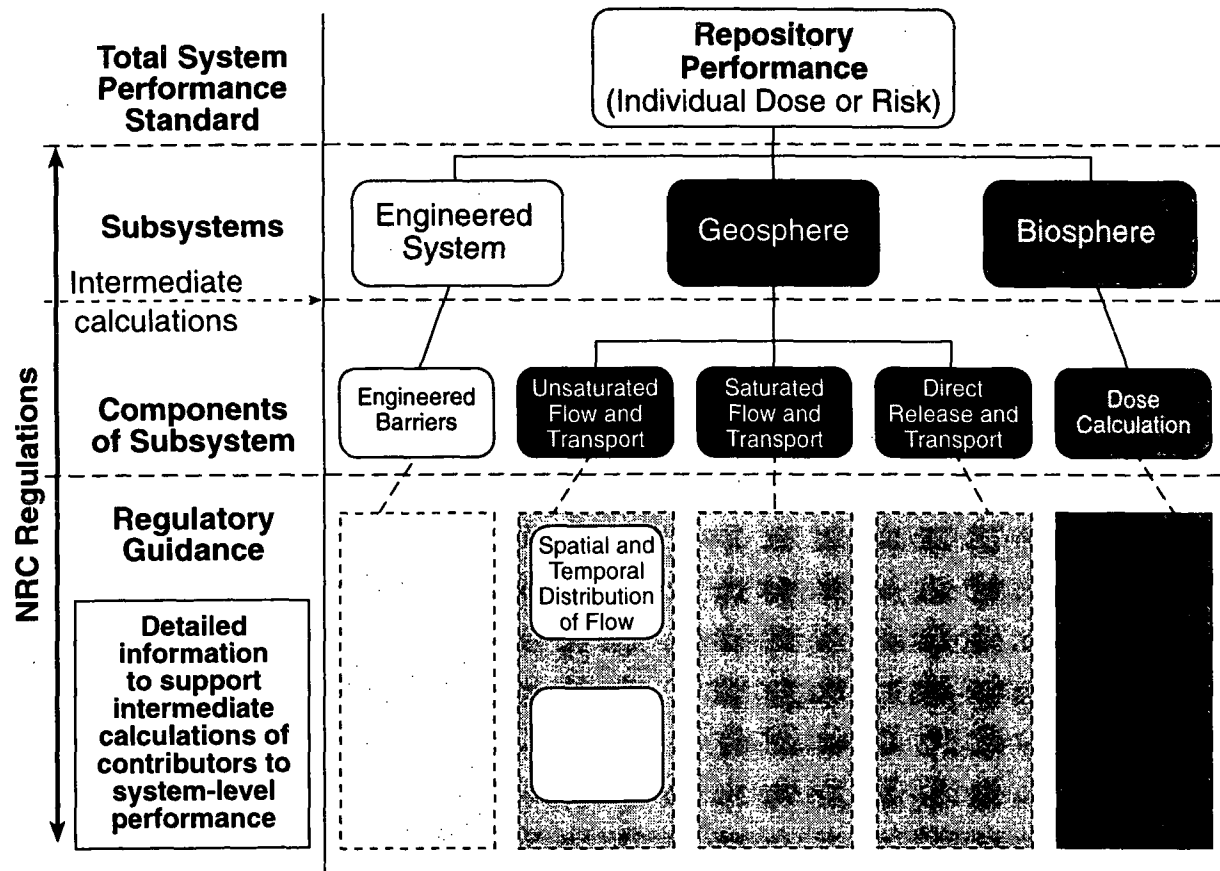
PROFILE OF HLW TECHNICAL EXPERTISE

- **Core NRC Staff Expertise**
- **Core CNWRA Staff Expertise**
- **Core Staff Involvement in The Technical Community**
- **Augmentation With External Consultants**
- **Utilization of External Consultants**

R&D 100 AWARD FOR 3DSTRESS

- **Significance of R&D 100 Award**
- **Technical Innovations in 3DStress**
- **Significance of 3DStress to Yucca Mountain Effort**

PROPOSED NRC REGULATORY FRAMEWORK FOR YUCCA MOUNTAIN



KEY TECHNICAL ISSUE PRIORITIES

<u>Key Technical Issue</u>	<u>Priority FY97</u>	<u>Priority FY98</u>	<u>Priority FY99</u>
Total System Performance	High	High	High
Part 63 Rule	High	High	High
Unsaturated/Saturated Flow	High	High	High
Near-Field Environment	Medium	Medium	Medium
Radionuclide Transport	Low	Medium	High
Container Life & Source Term	Medium	Medium	High
Thermal Effects on Flow	High	Medium	Medium
Igneous Activity	High	Low	Low
Repository Design & Thermal Mechanical Effects	Low	Low	Medium
Structural Deformation & Seismicity	Medium	Low	Low

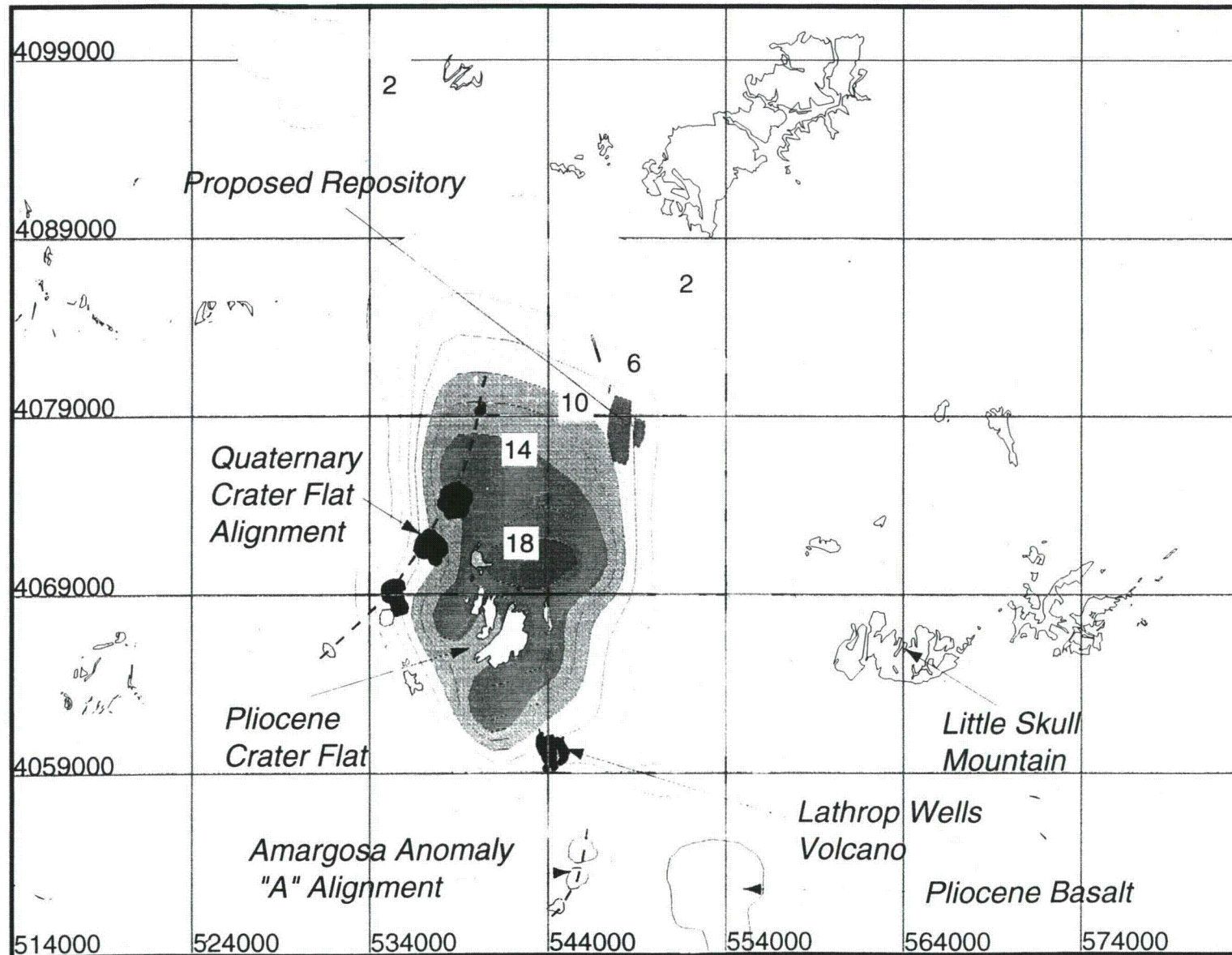
**PROGRESS TOWARD ISSUE RESOLUTION:
SUBISSUES CURRENTLY RESOLVED AT
THE STAFF LEVEL**

- **Probability of Igneous Activity**
- **Rate of Shallow Infiltration**
- **Climate Change**
- **DOE Thermal Testing Program**
- **Use of Expert Elicitation**
- **Method for Probabilistic Seismic Design**
- **Dry Oxidation of Waste Containers**

**PROGRESS TOWARD ISSUE RESOLUTION:
EXAMPLE OF A SUBISSUE CURRENTLY
RESOLVED AT THE STAFF LEVEL**

- **Central Topic is the Probability of Volcanic Eruptions Affecting Repository Performance During the Compliance Period**
- **NRC/CNWRA Work Bounds the Probability of Eruption Through the Repository of 10^{-7} / yr**
- **Recent Crustal Strain Measurements Suggest Volcanic and Seismic Hazards may be a Factor of 10 Greater**

PROGRESS TOWARD ISSUE RESOLUTION: EXAMPLE OF SUBISSUE CURRENTLY RESOLVED AT THE STAFF LEVEL

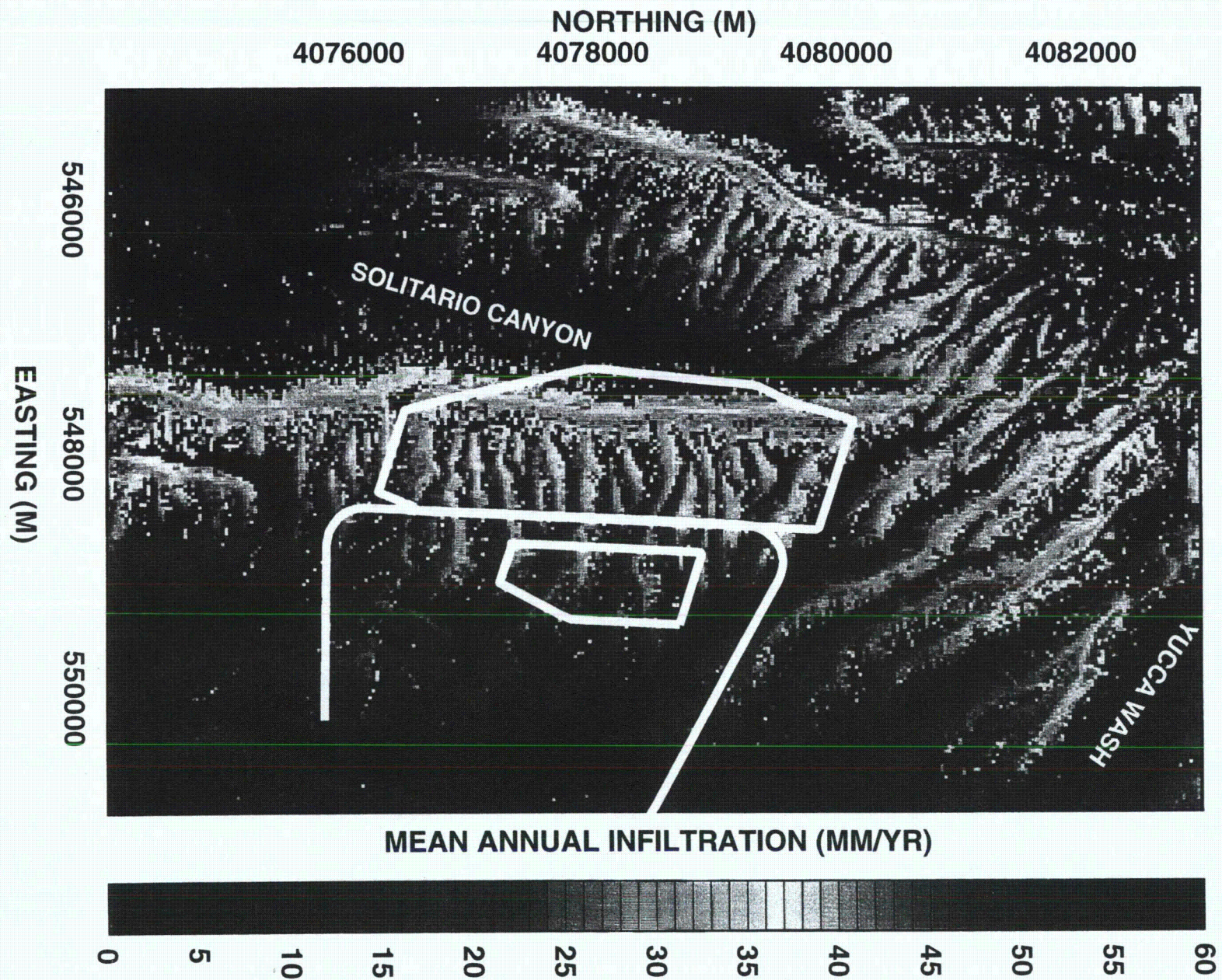


PROGRESS TOWARD ISSUE RESOLUTION: SUBISSUES NEARING RESOLUTION AT THE STAFF LEVEL

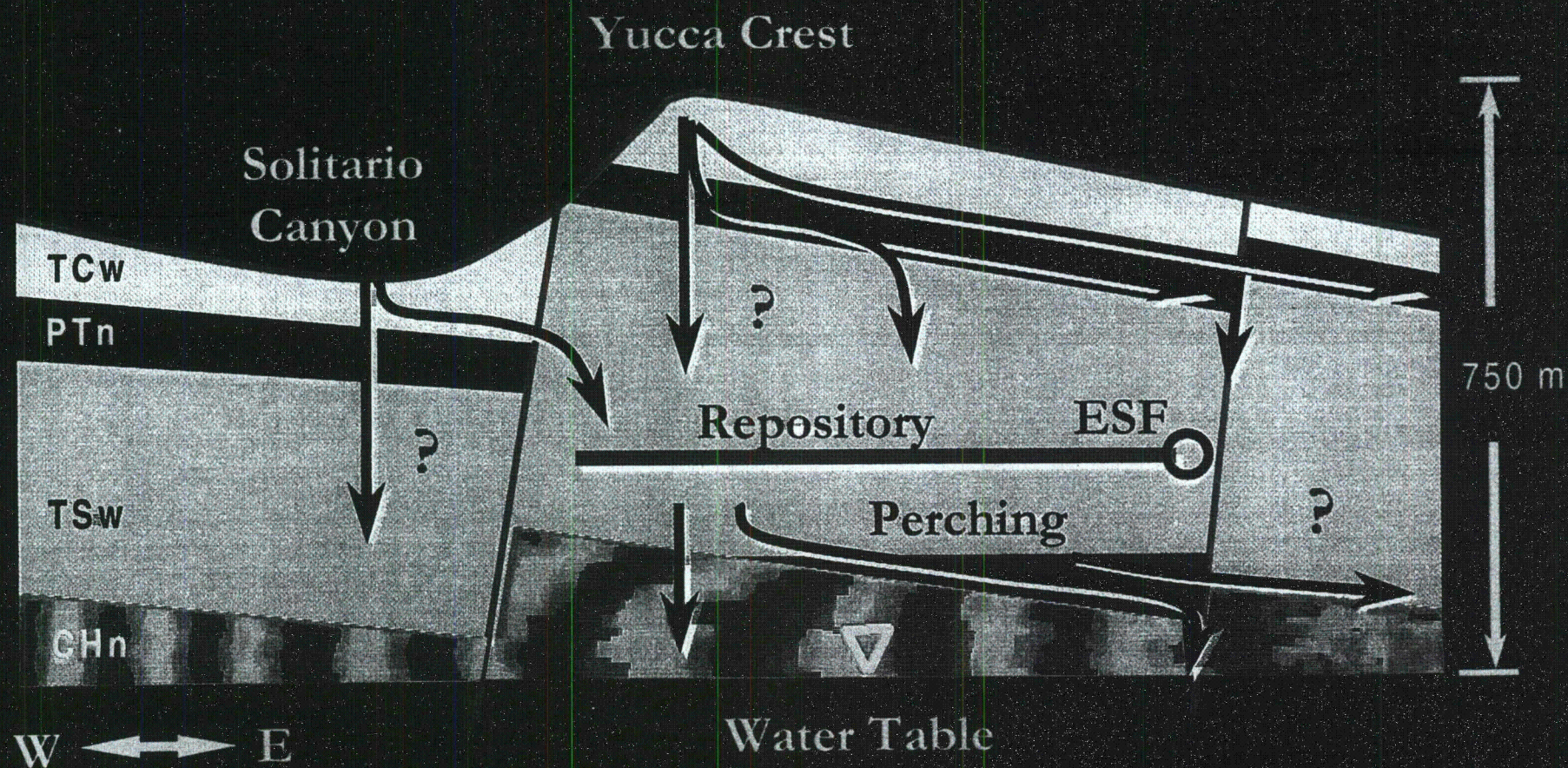
- **Deep Percolation**
- **Temperature and Humidity Around Waste Packages**
- **Dilution in Saturated Zone**
- **Scenario Analysis Approach**
- **Tectonic Model of Yucca Mountain Region**
- **Consequences of Igneous Activity**

**PROGRESS TOWARD ISSUE RESOLUTION:
EXAMPLE OF A SUBISSUE NEARING
RESOLUTION AT THE STAFF LEVEL**

- **Rate of Shallow Infiltration Provides the Upper Bound for Deep Percolation**
- **Fractures and Faults Affect the Rate of Deep Percolation**
- **Lateral Diversion of Flow at Stratigraphic Boundaries and Mineralogically Altered Zones**
- **Deep Percolation Rate is Bounding Estimate for Seepage into the Repository Drifts**



Deep Percolation at Yucca Mountain



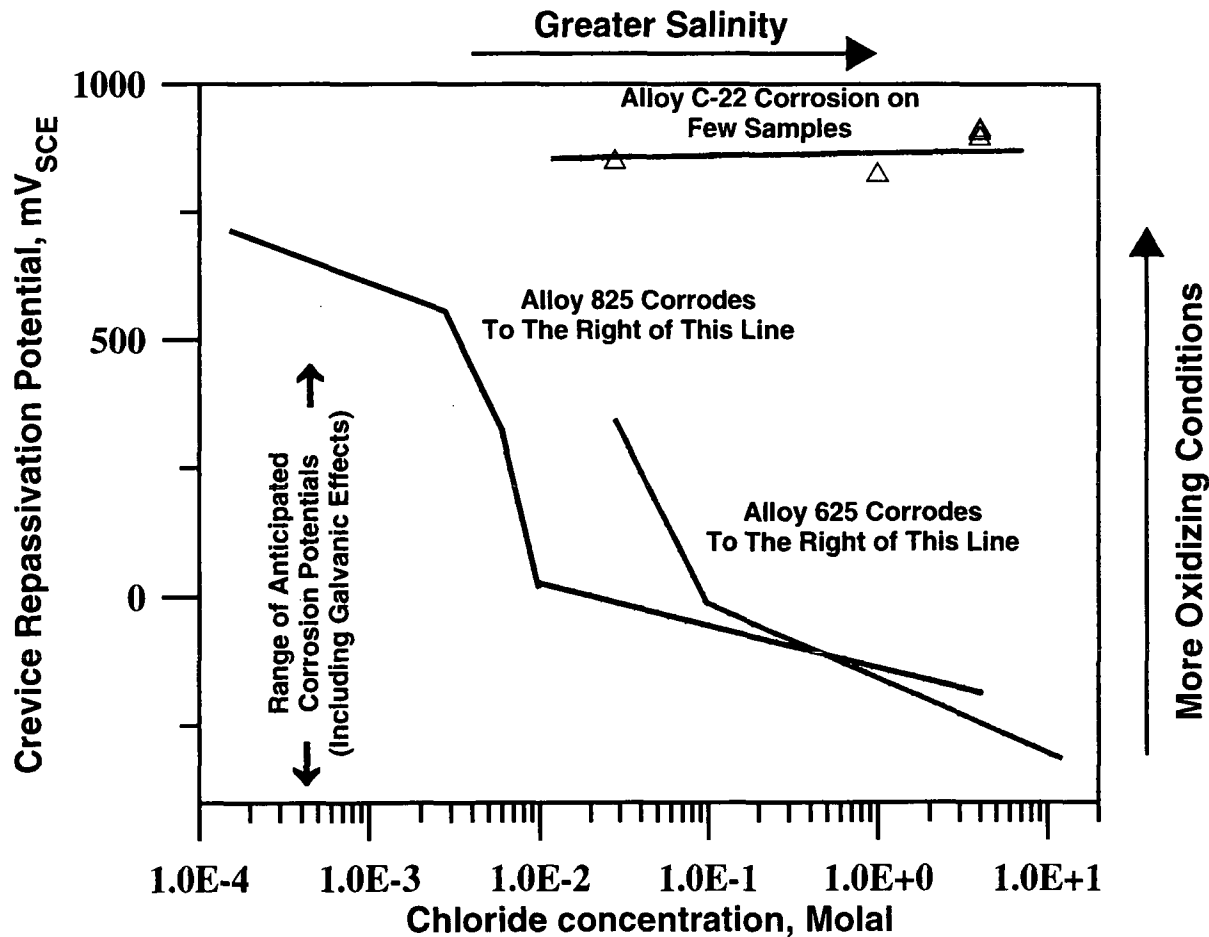
PROGRESS TOWARD ISSUE RESOLUTION: SUBISSUES WHERE RESOLUTION IS MORE DIFFICULT

- **Redistribution of Water Flux Due to Thermal Effects**
- **Matrix Diffusion**
- **Effects of Thermal-Hydrological-Chemical Couplings**
- **Effects of Thermal-Mechanical Coupling**
- **Estimation of Waste Package Lifetime**
- **Rate of Release of Radionuclides**
- **Probability and Consequences of Faulting**
- **Abstraction of Models for Use in PA**

**PROGRESS TOWARD ISSUE RESOLUTION:
EXAMPLE OF A SUBISSUE WHERE
RESOLUTION IS MORE DIFFICULT**

- **Developed a Predictive Approach for Assessing Localized Corrosion**
- **Developing an Approach Based on Critical Temperature for Localized Corrosion of Alloy C-22**
- **Addressing Uncertainties in Container Life**

ANTICIPATED PERFORMANCE OF CORROSION RESISTANT MATERIALS



- Alloy 625 is better than alloy 825 only below 0.1m chloride concentration
- Alloy C-22 did not suffer localized corrosion unless very high potentials were applied.
- Corrosion potential is not anticipated to rise above about 400 mV

PRINCIPAL ELEMENTS OF THE DOE VIABILITY ASSESSMENT

- **Preliminary Design Concept for Critical Elements of the Repository and Waste Package**
- **Total System Performance Assessment Based on Design Concept and Available Scientific Data and Analyses — Describe Probable Behavior**
- **Plan and Cost Estimate for Work Remaining Before Completion of the License Application**
- **Estimate of Costs to Construct and Operate the Repository in Accordance with the Design Concept**

OBJECTIVES AND APPROACH FOR NRC'S VA REVIEW

- **Identify Progress Toward a Complete License Application**
- **Identify Potential for Licensing Vulnerabilities**
- **Identify Major Issues with DOE's Test Plans, Designs, and TSPA that if not Resolved Might Result in an Incomplete or Unacceptable License Application**
- **Focus Review on KTI's and Use Acceptance Criteria in IRSRs**

CONCLUSIONS

- **All KTIs Will Be Partially Resolved at the Time of VA**
- **Significant Progress on Development of Risk-Informed, Performance-Based Regulation**
- **Feedback and Interactions with DOE Have Resulted in Significant Progress Toward Issue Resolution**
- **Total System Performance Assessment Capability Used Throughout the Program**