UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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PUBLIC MEETING

Nuclear Regulatory Commission
One White Flint North
Rockville, Maryland

Tuesday, January 25, 1994

The Commission met in open session, pursuant to notice, at 1:30 p.m., Ivan Selin, Chairman, presiding.

COMMISSIONERS PRESENT:

IVAN SELIN, Chairman of the Commission
KENNETH C. ROGERS, Commissioner
FORREST J. REMICK, Commissioner
E. GAIL de PLANQUE, Commissioner

STAFF SEATED AT THE COMMISSION TABLE:

ANDREW BATES, Office of the Secretary

STUART TREBY, Assistant General Counsel for Rulemaking and Fuel Cycle

HUGH THOMPSON, Deputy Executive Director for Nuclear Materials Safety, Safeguards & Operations Support

ROBERT BERNERO, Director. NMSS

WESLEY PATRICK, CNWRA

BUDHI SAGAR, CNWRA

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

2 1:30 p.m.

3 CHAIRMAN SELIN: Good afternoon, ladies
4 and gentlemen.

5 The Commission is pleased to welcome
6 representatives from the Center for Nuclear Waste
7 Regulatory Analysis to brief us on the status and
8 activities of the center. Mr. Taylor will introduce
9 the speakers for us -- oh, Mr. Thompson will introduce
10 the speakers for us in just a moment.

11 MR. THOMPSON: You've got to watch us.

12 CHAIRMAN SELIN: Right. Well, you've met
13 one EDO, you've met them all.

14 MR. THOMPSON: Oh, no.

15 CHAIRMAN SELIN: The Southwest Research
16 Instituted has operated the Center in support of our
17 high-level waste management program for more than six
18 years. We are relying on the Center to provide
19 technical assistance, including support of regulatory
20 development review of the ongoing high-level waste
21 management disposal program license application review
22 capability and performance of high-level waste.

23 The Commission is pleased to support this
24 technical organization. I understand the staff has
25 recently completed a six month periodic performance

1 evaluation of the Center which was rated excellent.
2 So, I congratulate you on that. We're looking forward
3 to hearing about your most recent activities and
4 accomplishments.
5 But, Doctor Patrick, I think it would be
6 useful if you could try to tie these in a little more
7 closely than sometimes has been the case with
8 activities that are going on in the high-level waste
9 program itself. The implications are at least as
10 interesting as the research itself.
11 Gentlemen? Gail?
12 MR. THOMPSON: Thank you, Mr. Chairman,
13 Commissioners.
14 This is the eighth briefing that the
15 Center has given to the Commission on the activities
16 out there. One of the key elements that I remember
17 when I first took over as the Director of the Office
18 of Nuclear Material Safety and Safeguards is the
19 selection that we made for the Center. So, I've seen
20 it with certain pride grow from a small outfit up to
21 its present state of robustness which we will hear
22 some of the results today.
23 Bob Bernero will start today's briefing
24 with a general overview. Wes Patrick and Budhi Sagar
25 will give us the details and I would like to note in

1 the audience is Martin Goland, who is the President of
2 the Southwest Research Institute. He has been
3 committed to support of the Center since its inception
4 and again he continues to do that and I appreciate his
5 support for this effort.
6 Bob?
7 MR. BERNERO: Thank you.
8 You asked for briefings on a number of
9 subjects really. First of all on current and
10 significant technical issues and the Center is
11 prepared to brief you on that today. You also
12 requested a briefing on systematic regulatory
13 analysis. We are scheduling a separate briefing on
14 that. We're working with the agenda planning right
15 now. It appears to be about the first week of April.
16 I'm not sure of a date on it yet.
17 As Hugh said, the Center was selected some
18 years ago and they have now essentially reached the
19 core professional staff level. They're not quite
20 there. They're almost at the projected level of 54
21 and they are expected to be there shortly because of
22 recruitment activities that are going on and they have
23 a limited term employee on base now, a geochemist.
24 The funding of the Center is fairly
25 significant. This is our federally funded research

1 and development center for high-level waste. This
2 year's funding is approximately $15 million. Of that,
3 $9.7 is the high-level waste program and the overhead,
4 of course, for maintaining the Center, and $5.6 is
5 research work placed at the Center. The Center in
6 their expenditure and management control is running a
7 little bit less than ten percent under spent, but that
8 is within reasonable fluctuations and I think
9 everything will be on target for the fiscal year. So,
10 basically, the Center is being a well managed and very
11 significant technical resource for the program.
12 Now I'd like to turn it over to Wes
13 Patrick to cover the issues of the day.
14 DOCTOR PATRICK: (Slide) Okay. If we
15 could move directly to slide 3 and get into the core
16 of the briefing.
17 We do want to take an issues-based
18 approach with you in our briefing this year, as we did
19 in the last briefing. That provides us with an
20 opportunity to not only identify the issues, but also
21 to indicate to you the progress we've made toward
22 resolving those at the staff level. As the Chairman
23 pointed out, those activities headed in the direction
24 of resolution include not only research but a good
25 deal of technical assistance activities as well.

1 Slide 3 indicates a grouping of all of the
2 work of the Center. It can be broken down into five
3 basic areas. Now, the first three of those are
4 primarily the sources of identification of
5 uncertainties or issues as we'll call them for the
6 purpose of the briefing today. Although the last two,
7 development of our analytical capabilities, which is
8 done as a technical assistance activity in the
9 Division of High-Level Waste Management, and then of
10 course the research topics, although those also lead
11 sometimes to identification of issues, they are
12 primarily geared toward closure of issues, of
13 resolving those problems, those what we call key
14 technical uncertainties that have been identified
15 throughout the program. We'll be addressing aspects
16 of each one of these as we go through the presentation
17 today looking at a total of six particular issues.
18 I would just as starting out though note
19 that the systematic regulatory analysis which Bob
20 spoke to a moment ago you were going to get a special
21 briefing on has been an area of some rather
22 significant accomplishment and progress this past
23 year. It's an area where we worked very closely with
24 your staff, teaming with them in the development of
25 several key documents, the foremost of which is the

1 license application review plan. Those activities,
2 particularly the development of key technical
3 uncertainties which form the basis for the issues
4 we'll talk about today, has been a substantial staff
5 effort this year and we will soon be seeing the
6 publication of the Revision 0 of the license
7 application review plan.
8 I'd also note here, and we'll pick up in
9 some detail as we go along, the second phase of the
10 iterative performance assessment which is a joint
11 NMSS, Research and Center activity. It's focused on
12 developing the tools that the staff will use for
13 reviewing the actual license application when it's
14 received. As Doctor Sagar will indicate in his
15 remarks a little bit later on, it also provides
16 several key pre-licensing roles, among which is to
17 conduct sensitivity analyses which give us indication
18 of those areas which we need to focus our activities
19 and our endeavors on.
20 I would note also the importance of pre-
21 licensing activities because those give us keen
22 insights into what the Department of Energy is doing,
23 how they are progressing on their program, what their
24 study plans are, what the results of those studies
25 have been to date as reported in topical reports and

1 also in just some of the normal technical reporting
2 that goes on in the course of their work.
3 We have currently a total of 13 research
4 projects underway and we will not be focusing on each
5 one in particular, but we'll be weaving into the
6 discussion of the issues as we progress particular
7 areas where we've made progress in addressing issues.
8 (Slide) Slide 4 indicates six broad
9 issues which we intend to discuss with you today. The
10 first five are probably familiar with you. They were
11 the subject of our briefing last year. I want to
12 point out that although the issues remain the same,
13 we're going to focus today not on the discussion of
14 the issues so much but the areas where substantive
15 progress has been made to bring you up to date on
16 that.
17 The sixth area, multiple purpose canister,
18 we've added this year because of its potential impact
19 on several elements of the program and our support to
20 the NRC.
21 Slide 5 indicates the first of the issues
22 that we'd like to discuss with you today, data and
23 models of the processes and conditions that would be
24 expected to be working, operating at the repository.
25 We find that the sufficiency of data and the

1 credibility of the models that are used to predict
2 repository performance are probably the two most
3 critical factors in the licensing of a high-level
4 waste repository. One of the complicating factors is
5 that most geological investigations are, by their very
6 nature, disruptive to the site. They require the
7 boring of holes, the sinking of shafts, the driving of
8 tunnels. So, there has to be some sort of a
9 compromise between acquiring all the data that one
10 might want and yet not having an untoward affect on
11 the performance of the repository. As a result of
12 that, we anticipate that repository licensing will
13 proceed with a measure of data, but that that data
14 will be somewhat more sparse then perhaps what the
15 ideal might be. Consequently, there will be a need
16 for introducing expert judgments in the elicitation of
17 those judgments.
18 This issue could really be summarized in
19 two very simple questions, how much data is enough and
20 what level of detail is appropriate for the modeling
21 of these very complex aspects of performance.
22 We have found that the site investigations
23 that have been ongoing to date at the Yucca Mountain
24 and its vicinity, like most geological investigations
25 are indicating that they're going to be alternative

1 conceptual models developed for how that site will
2 perform and how the various processes will take place.
3 Some of those alternative hypotheses are going to be
4 equally credible and that's going to introduce another
5 level of complexity to the program. We'll, of course,
6 be needing to count on reasonable assurance for
7 performance as being a measure of the adequacy of
8 those investigations and evaluations that take place.
9 I'd like to focus in on now just two of
10 the four areas of progress that we have indicated on
11 the slide to give you an indication more specifically
12 of some of the activities that have been ongoing at
13 the center. The first of those in the area of
14 alternative conceptual models of unsaturated flow
15 deals with an analysis we conducted using data from
16 two bore holes which the Department of Energy sunk at
17 the Yucca Mountain site. We and a number of other
18 investigators studied the flow of groundwater as it
19 was expressed in the moisture profile along those bore
20 holes.
21 We found that the rate of infiltration
22 that could result in the observed profiles depended on
23 three things predominantly. One, whether one
24 considered fracture flow or only matrix flow occurring
25 at the site. Second, whether the flow was considered

1 in one, two or three dimensions, the higher
2 dimensionality allowing flow out of the plane of the
3 bore hole. And finally, whether one could assume the
4 existence of a very thin geological layer in the
5 profile which was assumed to be some measure of
6 barrier to the flow of groundwater from the surface to
7 the lower levels.
8 We believe that as the site
9 characterization proceeds, analyses like these are
10 going to be needed to be conducted in parallel with
11 the selection of further studies for the site so that
12 the number of credible conceptual models that might be
13 proposed can be limited to some reasonably manageable
14 set.
15 If we could have the photo 5-A and move to
16 a second point here.
17 COMMISSIONER REMICK: Excuse me, Wes.
18 DOCTOR PATRICK: Yes.
19 COMMISSIONER REMICK: I was anxious to
20 hear what the results were of that study where you
21 used the bore holes and the data.
22 DOCTOR PATRICK: One of the very I think
23 nothing short of profound results was that the wide
24 range of models that could be used to obtain
25 essentially the same moisture profile. That indicates

1 to us that the common measure that's used, or used to
2 date anyway, to calibrate these models to determine
3 their adequacy, their validity, is probably
4 insensitive. So, monitoring the profile of moisture
5 in bore holes is very likely not going to lead to any
6 discrimination between the various alternative models
7 that might be available. Now, the various researchers
8 involved used wide ranges of infiltration. Some used
9 fracture flow, some did not, different
10 dimensionalities of the problems were used and so
11 forth. But we did not find a great deal of
12 discrimination amongst the different models based on
13 moisture content as a function of depth along those
14 bore holes.
15 MR. BERNERO: Wes, isn't it fair to add
16 that that research did not include significant thermal
17 effects as a driving force which will further
18 complicate it?
19 DOCTOR PATRICK: That's correct. It
20 assumed strictly an isothermal case as exists in the
21 field unperturbed along these two bore holes.
22 Any other questions before we proceed?
23 COMMISSIONER ROGERS: Yes. Just on the
24 importance of coupled processes. Does that comment
25 refer to also what you've just been talking about, the

1 different types of flows, or are you talking about
2 something quite different here in the way of
3 processes?
4 DOCTOR PATRICK: This particular study
5 looked only at the isothermal conditions, looking
6 simply at the flow of the infiltration of moisture and
7 the resulting moisture profile that would occur. Our
8 anticipation would be that as we go to the more
9 complex processes where, as Bob had alluded to, you
10 have thermally driven conditions, the possibility of
11 buoyant forces coming into play, that it could become
12 even more complex.
13 COMMISSIONER ROGERS: Well, how far have
14 you gone on coupled processes?
15 DOCTOR PATRICK: The second bullet there
16 in particular deals with a much broader study of
17 coupled processes than what was alluded to in the
18 first two bore holes. We started from the basics with
19 our coupled processes study conducting a very thorough
20 literature review. One of the things that we've found
21 is that the processes that are important, the degree
22 of coupling between the processes that are important,
23 varies depending on the time period that's involved.
24 More specifically, we've found that during
25 the preclosure phase of the repository most of the

1 processes of interest could be -- most of the
2 couplings could be eliminated or avoided in the
3 analyses.
4 The key thing that needs to be focused on
5 during that period of time are the thermo mechanical
6 couplings because those are most important to near
7 field bore hole and drift stabilities that are of
8 concern during the operational period. Once closure
9 has occurred and long-term performance comes into play
10 under the particular provisions of 10 CFR Part 60,
11 then more complex couplings there looking at the
12 chemical hydrological and thermal couplings become the
13 most important.
14 We have specific research projects that
15 are ongoing in each of those areas. Nothing really
16 conclusive to state at this time other than to say
17 that our specific efforts at qualifying the computer
18 codes that do exist are indicating that there are a
19 number of shortfalls for the codes in each of these
20 areas, both for the mechanical processes and also for
21 the thermal hydrological processes that exist. It's
22 an area for a good deal of additional research and
23 then once that research is completed, there may be
24 some areas where staff guidance is going to be
25 appropriate in these areas.

1 I would note that the staff has prepared
2 a staff technical position. The NRC staff has
3 prepared a staff technical position dealing with the
4 effects of coupled modelings during design processes
5 that DOE should be cognizant of. There the focus is
6 predominantly on design, but of course the
7 implications for performance are obvious.
8 COMMISSIONER ROGERS: All right. Thank
9 you.
10 DOCTOR PATRICK: Anything else before we
11 proceed?
12 (Slide) If I could have the photo, the
13 site photo of 5-A up, please.
14 One of the other areas that we have spent
15 considerable effort in investigating this past year is
16 estimating the probability and the consequences of
17 volcanism. If one stands in the desert and looks
18 toward, as indicated in the figure here, the Yucca
19 Mountain crest, it's fairly obvious why volcanism is
20 of some concern to the NRC. There are several
21 volcanic cinder cones that are evident in the area and
22 both the Department of Energy and ourselves have been
23 conducting investigations to determine where those
24 might occur, when any renewed volcanism may occur and
25 equally, if not more important, what the consequences

1 of that volcanism might be to repository performance.
2 We have done several things this past
3 year. We started with a very comprehensive review of
4 the literature looking at two things. First, the
5 understanding of the volcanological processes that
6 exist in geographical and geological areas similar to
7 Yucca Mountain, focusing in on basin and range
8 province volcanism. And second, what kind of
9 techniques exist and how accurate are they for
10 indicating the age of these volcanic events. The
11 Department of Energy published a major report during
12 this period of time, a Los Alamos National Laboratory
13 report reviewing the last 10 to 12 years of
14 volcanological research in this area. We reviewed
15 that report in detail and found several areas that
16 were of concern to ourselves and NRC staff and we've
17 challenged some of DOE's assertions, namely that the
18 volcanism is waning, that it's dying out with time,
19 that DOE's indication that there's a low water content
20 and consequently a very benign sort of effusive
21 volcanism that may occur at the sight, were it to
22 occur. We have questioned the dates on the volcanic
23 events. Some of the ranges on those events are so
24 large that they are nearly the same as the mean age
25 for the events. And finally we've challenged the use

1 of their approach to predicting where the volcanic
2 events might occur. Namely, their view is that they
3 are spatially homogeneous in a statistical sense.
4 We are looking at non-homogeneous models
5 and finding that treating statistically non-
6 homogeneous occurrence of those events does make a
7 difference from the standpoint of probability of
8 eruption that could disrupt the repository. More
9 importantly, we're trying to take it the next step and
10 that is to get away from simply a statistical point of
11 view and to begin to introduce structural aspects to
12 the occurrence of volcanism and the prediction of that
13 occurrence.
14 One of the tools that we are using to
15 specifically look at the consequences of volcanism is
16 to look at very modern volcanic systems, those that
17 are erupting now or have a historical record of
18 erupting. We want to use what we observe there to
19 give us an indication of what might occur if volcanism
20 were to be renewed in the Yucca Mountain area and
21 specifically what consequences the existing volcanism
22 may have had during the period of active eruptions.
23 As I'd indicated before, we're
24 aggressively involved in prelicensing interactions
25 with the Department of Energy. We see that as being

1 a very important element of our ability to make
2 progress toward resolving this issue. Issues of the
3 sort of I mentioned, particularly in volcanism, the
4 issues regarding the different kinds of models that
5 might be presented for flow and transport are crucial
6 to the performance of the repository and those are
7 best addressed by the technical staff interacting with
8 one another on a regular basis.
9 We do, of course, have anticipation of
10 finalizing over the coming months and years two very
11 important guidance documents, the format and content
12 regulatory guide which indicates to the Department of
13 Energy the levels of detail that are expected with
14 regard to their data and models of processes and
15 conditions and also the license application review
16 plan, which is more of an internal document indicating
17 how the staff would review and judge the acceptability
18 of the data and the models that are presented in the
19 license application.
20 Budhi?
21 MR. SAGAR: The next feature we talk about
22 is the validation of models. Because of time and
23 space scales involving the repository system of
24 predicted mathematical model, models would be the
25 primary tool that we believe would be used to show

1 compliance with the safety standards. From the NRC's
2 point of view, the issue is what criteria should be
3 used to determine the degree of confidence in these
4 models.
5 What complicates this, the resolution of
6 this issue, is that it's not always possible to
7 differentiate between deficiencies in models and the
8 deficiencies in data against which these models are
9 evaluated.
10 The staffs of the NRC and the Center have
11 participated in a recently concluded international
12 program known by its name of INTRAVAL. The focus of
13 this program was to study the issue of model
14 validation primarily in the context of flow and
15 transport models, not in the context of the total
16 systems performance assessment.
17 There was fair agreement in this group
18 that while it may be possible to make assumptions
19 regarding the adequacy of models, it's impossible to
20 fully validate, and those are in quotations, these
21 models in the scientific sense. A post-INTRAVAL
22 international project to study this issue further is
23 being planned.
24 Other aspect of model validation we are
25 studying through the study of natural analogues

1 because natural analogues can provide important
2 information on processes at the scales, at the space
3 and time scales of the repository. We have selected
4 the Peña Blanca site in Chihuahua, Northern Mexico and
5 an archeological site on the Greek Island of Centerini
6 as two natural analog sites for study. Both of the
7 sites will be studied in the context of long-term
8 migration of contaminants. The Peña Blanca site, and
9 we have a picture that we brought with us, exhibits
10 geologic and climatic regimes that are very similar to
11 that of Yucca Mountain and the advantage of studying
12 the site is that there is a built-in source term from
13 an existing uranium ore body.
14 Preliminary analyses that we have
15 performed indicate about three things that I want to
16 mention here, that the most recent migration episode,
17 migration of uranium oxide that is, occurred about
18 50,000 years ago. This is based on the age dating
19 that we did. The important thing to keep in mind
20 while looking at this conclusion is that in sites like
21 Yucca Mountain which are in arid climate, that
22 migration of contaminants may occur not as a
23 continuous process but as pulses in time.
24 Number two thing that we concluded from
25 this is that migration of uranium was limited to

1 within about 25 meters from the ore body. All that
2 tells us is that the migration rate is pretty slow
3 and, number three, that migration is greatly
4 influenced by the fractured nature of the tuff. We do
5 see a preferential migration part following the
6 fractures.
7 Data from Centerini, which is the second
8 natural analog site, has established that the
9 transport properties of the volcanic tuff are similar
10 to those at the proposed repository horizon at Yucca
11 Mountain and the good thing about Centerini is that we
12 know quite precisely how old that site is and
13 therefore the time at which the source term was
14 created is well known.
15 Further investigations hopefully would
16 reveal the pattern of migration. It's quite clear
17 that confidence in models will be obtained through the
18 application to a variety of situations that span the
19 scales evident in the repository system. Most of the
20 scientific community involved in the high-level waste
21 disposal is of the view that validation is probably
22 the incorrect term for this process. Other terms such
23 as confidence building or model testing would be more
24 appropriate. Thus, it may become important for the
25 repository process to develop appropriate guidance on

1 this issue. In this regard, the staffs of the NRC and
2 the CNWRA and the Swedish regulatory agency SKI are
3 currently developing a position paper on model
4 validation from the prospective of the regulators.
5 This position will be presented at the '94 symposium
6 that is scheduled to occur in October of this year.
7 MR. BERNERO: Budhi, I wonder if I could
8 interject here. This is a very sensitive problem,
9 this matter of model validation or code validation and
10 there's a lot of international interest in it. We
11 often cite a former Chairman of the Commission who
12 spoke of the assurance in high-level waste is not
13 proof in the ordinary sense of the word. People are
14 also saying this is validation but not validation in
15 the ordinary sense of the word.
16 There is a great deal of concern about
17 terminology, but a fact remains. In modern society
18 there are many models that are so complex that you
19 can't really validate them. Further complicating the
20 models in high-level waste is the time scale, their
21 processes which are so slow that it makes it even more
22 difficult to model.
23 There are models, we have these very
24 exotic aircraft, very exotic structures where
25 ultimately you can validate the model by building it

1 and discover failure that way, but you can't do that
2 with a repository. So, the point I would make is
3 that the international community, just last week the
4 Radioactive Waste Management Committee at OECD
5 discussed this at some length. There is a concern
6 about the terminology. The intent is as Budhi says,
7 to go as far as we can to get an understanding and to
8 validate or build confidence or whatever we would call
9 it, but being very careful about what we call it too
10 so that we don't mislead. But it is not validation in
11 the ordinary sense of the word.
12 COMMISSIONER REMICK: I assume that the
13 pulse nature of the migration of the ore body in the
14 Peña Blanca site is due to changes in precipitation,
15 through climatic changes and so forth?
16 MR. SAGAR: That's the reason we expect,
17 yes. But it's also because the precipitation is not
18 the average quantity that you say. It's only one
19 millimeter a year. It does occur in episodes and that
20 influences the migration pattern.
21 COMMISSIONER REMICK: What you mentioned
22 in migration was about 25 meters, am I correct? But
23 do you know if that was with one episode or that's the
24 cumulative effect of perhaps a number of episodes?
25 MR. SAGAR: That is the cumulative, the

1 total that we have observed.

2 The next issue that we would like to bring
3 forth here is the effectiveness by which we can use
4 the early site characterization data that has started
5 coming in. In addition to the surface based site
6 characterization activities, especially in the past
7 year, DOE initiated construction of its underground
8 experimental facilities. Real time analysis and
9 reduction of the early site data by DOE to evaluate
10 site suitability and to assess the testing strategies
11 for the future and analysis by the NRC to review
12 repository and engineered barrier design and therefore
13 draw inferences on suitability of data will be vital,
14 we believe, to the success of this project.

15 We also know that this is not an area
16 really where the NRC and the CNWRA can be particularly
17 proactive. The principle actions to be taken are
18 DOEs. These include providing prompt access to the
19 data, publication of DOE's topical and periodic
20 reports and publication of DOE's iterative performance
21 assessment, and to conduct technical exchange meetings
22 with the NRC.

23 Nonetheless, we are beginning to explore
24 currently available data. Three specific areas I'd
25 like to focus your attention to. The CNWRA staff has

1 entered into its geographic information, computerized
2 geographic information system database several levels
3 of data related to structural geology and we have a
4 picture that I'd like to project at this time. The
5 data includes stratigraphy, fault geometry,
6 topography, hydrology, geochemistry, et cetera. Some
7 of this data was obtained from the USGS in the digital
8 form and the other -- and some of the data was
9 digitized from maps. We now have the capability of
10 examining three dimensional geometry of any of these
11 geologic structures. The map that you see is produced
12 from this GIS database and we can rotate it, we can
13 look from whichever angle we want to, and we can
14 produce three dimensional hard copy maps which have
15 select attributes. We can ask to choose certain
16 attributes and plot only those.
17 Through such data interpretation we expect
18 to determine what correlation if any exists between
19 various structures. I might point out that the NRC
20 staff is also acquiring the same facilities here. So,
21 they would be able to manipulate the same database.
22 In FY '93, the Center started a new
23 research project related to the understanding of
24 hydrologic controls on the scale of the Death Valley
25 region and again I brought a picture with us to show

1 you the region that we are studying. In this project
2 we would strive to systematically examine the
3 hydrology and geochemistry data to determine which
4 geologic structure controlled the overall hydrology of
5 the region, including identification of recharge and
6 discharge areas. The main point is that in the next
7 10,000 years, whether the repository will get flooded
8 because the water table can rise up or by how much
9 would the recharge or discharge change, that's what we
10 want to look at. This is one step in determining the
11 effect of the future climate and potential future
12 reconfiguration of geologic structures on the water
13 table in the region.
14 Doctor Patrick has already spoken about
15 the third item, so I will not spend much time on it.
16 It relates to the studies we have done on the magmatic
17 activity of volcanism. The key elements of resolution
18 of this concern are timely release and acquisition of
19 such data by DOE and timely evaluation and use by both
20 DOE and the NRC staffs in their decision making
21 processes.
22 COMMISSIONER REMICK: Just looking at one
23 of your pictures there, it looked like the volcanic
24 cones were in a line. Is that true?
25 MR. SAGAR: The tree that you see, and you

1 can -- yes, you can draw a line through them, yes.
2 COMMISSIONER REMICK: But you don't know
3 if structurally that's the reason they're not --
4 DOCTOR PATRICK: That's correct.
5 COMMISSIONER REMICK: Yes.
6 DOCTOR PATRICK: As I had alluded to
7 before, that's one of the things that needs to be
8 investigated, and investigated not just at this site.
9 With so few cones, it's very difficult to get good
10 statistical information. It's also difficult to get
11 good structural control information. So, we're
12 looking at not only this volcanic field but four other
13 volcanic fields to try to examine things just like
14 that.
15 Another common piece of wisdom, if you
16 will, is that volcanism is topographically controlled,
17 but we have already found that there are particular
18 fields in the basin and range where that sort of
19 control does not seem to be evident under rigorous
20 statistical testing.
21 MR. SAGAR: (Slide) I'd like to move over
22 to slide 8, which deals with the use of expert
23 judgment.
24 The future performance of the repository
25 is greatly dependent upon the evolutionary changes in

1 its boundary conditions and forcing functions. These
2 in turn are controlled by tectonic, volcanic,
3 hydrologic, climatic and other processes. The main
4 point to note is that expert judgment, in one form or
5 another, is expected to be included in various
6 interpretations of these processes and events. The
7 matter of acquisition and extent to which subjective
8 expert judgment can be used in the regulatory process
9 are matters of concern. In particular, definition of
10 disruptive scenarios and associated probabilities that
11 are used to drive the performance estimates of the
12 repository are currently accomplished largely through
13 subjective means through the use of expert judgments.
14 Being a first-of-a-kind endeavor,
15 qualifications of experts, who are the experts in the
16 case of a 10,000 year structure, especially those who
17 are unbiased, is uniquely difficult in this project.
18 COMMISSIONER REMICK: Is any expert
19 unbiased?
20 MR. SAGAR: Yes. That's probably a dead
21 expert.
22 COMMISSIONER de PLANQUE: I think the last
23 time you briefed us on this issue, I believe I asked
24 if there had been much work done in the scientific
25 community on the acceptance of expert judgment on the

1 part of the public. I believe there wasn't too much
2 known at that time. Has anything happened in the
3 interval? Is anybody looking at that?
4 MR. SAGAR: Well, we did the study through
5 the use of consultants to look at the history of
6 expert elicitation and how accurate were those proved.
7 Obviously, most of those are in the business world
8 where the short-term predictions were made. Sports,
9 betting, for example. Climate is another -- the
10 weather is the other one. And the results were mixed.
11 Some were proved right, some were proved wrong. I
12 guess that's not a conclusive evidence of anything.
13 There have been studies, psychological
14 studies as to what kind of expert opinion gets
15 accepted by the public. We haven't delved deeply into
16 those.
17 COMMISSIONER de PLANQUE: One can just
18 imagine that in a very public process like ours, that
19 that is a question that's of some interest.
20 MR. SAGAR: There is some opinion from the
21 OGC that we have discussed which is that so long as
22 they can put the expert on the stand and question
23 them, that that becomes acceptable in the public
24 forum. But this being a long drawn out process, it's
25 not quite clear how that would get accomplished.

1 COMMISSIONER de PLANQUE: Yes.

2 MR. BERNERO: But there is the separate
3 forum. In the media discussions are made and experts
4 are extracted by one means or another to speak at the
5 different polls. Just last week, I believe it was,
6 McNeil-Lehrer had something on the high-level waste
7 where the program was criticized for constructing the
8 repository without the proper QA. I don't know if you
9 saw the program.

10 COMMISSIONER de PLANQUE: I saw it. I saw
11 it.

12 MR. BERNERO: You know, completely false
13 accusation, missed the point of site characterization,
14 but it's the way they -- and that's a very good
15 program, very good reporting. But if you draw almost
16 at random, that's what you get and that's the expert
17 opinion the public often listens to. They're not
18 familiar with the one on the stand who's testifying.

19 DOCTOR PATRICK: We found that, and Budhi
20 will speak to that next, the rigor and the very
21 specific form of the process that you follow for the
22 elicitation or the selection of experts and then their
23 elicitation seems to be crucial to their credibility.
24 Not just from a public perception point of view, but
25 also from the perception of their peers. Of course,

1 that's a good deal of what happens during a licensing
2 process, is, "My expert says this and your expert says
3 that. Now, where lies the truth?"
4 COMMISSIONER REMICK: The Agency has had
5 some experience and learned some lessons in the use of
6 expert judgment in the development of NUREG-1150.
7 Since this is one Agency, I assume that the Center is
8 aware of that experience and the lessons learned.
9 MR. SAGAR: Certainly, yes.
10 COMMISSIONER REMICK: It pleases me to see
11 you shaking your head.
12 MR. SAGAR: In fact, we used the
13 instructions in that NUREG to do a study, which I want
14 to report here. A main idea for us to do this was to
15 gain some understanding of the elicitation process and
16 see how the process actually applies to a real
17 problem. Also, we thought through this process we
18 might get some data that is not available from site
19 characterization at this time and that could be used
20 in the next phase of the iterative performance
21 assessment.
22 We conducted an expert elicitation on one
23 subject and that was related to the future climate at
24 Yucca Mountain. Five experts selected through peer
25 ranking, which I believe for the first time in the

1 sense that we formally asked their own peers to select
2 these five people, that to me was unbiased. Of course
3 they were biased technically speaking, but they were
4 not biased towards the project in any sense of the
5 word that we could determine.
6 So, we selected those five experts through
7 peer ranking and the questions posed to them were
8 related to the future precipitation for the next
9 10,000 years and the possible temperature changes at
10 Yucca Mountain. Careful records of the elicitation,
11 including videotapes, were kept. Experts were
12 providing information relevant to the site. They were
13 given a tour of the vicinity and they were asked to
14 prepare technical rationales for their opinions. They
15 actually went back and spent a few weeks to actually
16 look at the data and used their best knowledge to
17 figure out what answers to give.
18 All five experts -- and these are the
19 results we got from them. All five experts agreed
20 that the main factor that would control future climate
21 at Yucca Mountain is the physiography. That is the
22 existence of the range shadow effect because of the
23 mountain range. While experts produce different
24 probability curves for future precipitation and
25 temperature, the extremes, if we considered all the

1 five experts, and looked at the extreme values they
2 gave us, the extremes indicated at most a doubling of
3 precipitation. That's the 100 percent increase in
4 precipitation over the 10,000 years and the degrees in
5 average temperature of three degrees in 10,000 years.
6 They did consider for the short-term the carbon
7 dioxide, greenhouse effects.
8 We would use the results of the study and
9 plan to produce a guidance document on the subject in
10 the FY '94. Some of the preliminary conclusions from
11 the expert elicitation were, number one, the expert
12 elicitation, however well done, and this is important
13 and is emphasized by NRC several times, is not to take
14 the place of the data that can be collected on-site
15 without endangering sites isolation capabilities. So,
16 you do not not do the site characterization activities
17 and just move to expert opinions.
18 Number two, the unbiased selection of
19 experts is critical and, number three, full
20 documentation to the extent that results can be
21 reproduced if needed is essential.
22 (Slide) Moving to the next slide, we talk
23 about the subsystem and total system performance. The
24 subsystem and total system performance requirements
25 contained in 10 CFR Part 60 provide the regulatory

1 foundation for repository safety assessments. There
2 are two concerns on the subject. Number one, that the
3 performance requirements are stated clearly and
4 unambiguously, and number two, that the subsystem
5 requirements do indeed provide additional assurance
6 regarding safety of the system. These issues may have
7 to be revisited after the National Academy of Sciences
8 finishes its review and after the Environmental
9 Protection Agency develops its standards that will be
10 applicable to the civilian repository at Yucca
11 Mountain.
12 An additional question is the amount of
13 detail that must be included in the subsystem and
14 system models which Doctor Patrick also touched
15 earlier. Currently we are examining matters for
16 resolving technical uncertainties which we did through
17 the application of the SRA process, the systematic
18 regulatory analysis process. But there are two that
19 we are specifically working on. The number one is the
20 groundwater travel time requirement. Number two is
21 the substantially complete containment requirement and
22 these two are -- they are in 10 CFR 60.113.
23 The third thing we are working on is the
24 extent to which meeting the subsystem requirements
25 adds to the overall confidence in the safety of the

1 repository, some sense for that additional confidence
2 that's provided by meeting the subsystem performance
3 requirements.
4 The main problem in the groundwater travel
5 time requirement is the difficulties in defining the
6 phrases, fastest part of likely radionuclide travel
7 that exists in that rule and the disturbed zone in a
8 technically meaningful way. We are at this time
9 looking at defining them in the alternate method and
10 we are doing some numerical simulations to see if
11 those alternate words or phrases would indeed be
12 acceptable.
13 The technical meaning and means of
14 assessing substantially complete containment has been
15 the subject of ongoing study by CNWRA and NRC staff.
16 The current Center perspective is that, number one,
17 the regulatory record is clear with respect to the
18 substantially complete containment, applying the word
19 "substantial" to actual performance. And number two,
20 that it specifies really zero failures under
21 anticipated conditions. Number three, the failure may
22 be conveniently defined for purpose of this regulatory
23 requirement as any through-wall penetration. This
24 topic, by the way, I should point out is still under
25 discussion between us, between the Center staff and

1 the NRC staff and it's not completely resolved at this
2 time.
3 As Doctor Patrick said, we have completed,
4 together with the staff of NRC Office of NMSS and
5 Office of Research, the second phase of the iterative
6 performance assessment. The report has been written,
7 but is under management review at the NRC and at the
8 Center at this time. So, I'm not presenting any
9 results here. But the things that we have learned, at
10 least two or three things that we have learned from
11 that phase of the IPA, one of them is that time of
12 container failure has a direct correlation. We were
13 trying to see if the subsystem performance
14 requirements were directly correlated to the EPA
15 requirement in 191. The time of container failure has
16 a direct correlation we found when we calculated both
17 of them with the cumulative release, but we could not
18 find a direct straight correlation between the other
19 two requirements, which is the groundwater travel time
20 and the gradual release rate requirement and the
21 subsystems.
22 MR. BERNERO: Excuse me. That's a very
23 significant indication because we've known all along
24 that the groundwater travel time is a weak surrogate
25 for radionuclide transport. But I for one didn't

1 realize that slow leakage was a weak or non-direct
2 controller, that the package lifetime seems to be the
3 dominant one of the subsystem performance.
4 MR. SAGAR: The resolution of these issues
5 may have to be revisited, as I've stated before, after
6 the EPA formulates its standard for Yucca Mountain.
7 In addition, we believe that the interactive
8 performance assessments, along with their auxiliary
9 detailed analysis, are extremely important tools for
10 examining the site and design data on a real time
11 basis. We recommend that these exercises should be
12 continued by both the NRC and the DOE.
13 DOCTOR PATRICK: The first five issues
14 that we've examined then are ones that we've been
15 working on and have been a core component of our
16 program for the last several years.
17 The last item we'd like to discuss with
18 you is one that's newly identified this year. Namely,
19 the use of multiple purpose canisters which the
20 Department of Energy currently has under
21 consideration. These are inner containers, if you
22 will, which could be over packed to provide for
23 storage at a reactor at an interim storage facility
24 for transportation and possibly even for ultimate
25 disposal at the repository. We've done just a little

1 bit of work in this area focusing primarily on the
2 preliminary review of the regulatory basis for MPC and
3 what kinds of impacts multiple purpose canisters and
4 decisions attendant to those might have on the rest of
5 the repository.
6 The greatest regulatory concern from our
7 perspective, and it's a technical concern as well, is
8 that should there be a failure to fully integrate the
9 MPC into the overall repository program from the very
10 beginning, it may allow design decisions focused on
11 MPC to go forward which may cut off alternative
12 designs that would be favorable for repository
13 performance. We feel that early decisions regarding
14 the MPC then could, if not fully integrated, backed up
15 by appropriate studies of the performance of those
16 MPCs in the repository, could lead to incorrect
17 conclusions regarding their adequacy.
18 Thermal loading is a particular area
19 that's of interest to us. Most of the attention to
20 date has been given on such issues as criticality,
21 test and inspection and so forth. But again, those
22 seem to focus primarily on how the MPC would behave in
23 its early stages of life and don't think through the
24 process fully and integrate it with the ultimate
25 disposal of such packages at a high-level waste

1 repository.

2 Not too much that can be said at this
3 point other than to indicate that it's an area where
4 the NRC staff, and we've been party to those
5 discussions, has begun to meet and interact with the
6 Department of Energy and that's going to be crucial to
7 first identifying and then resolving the sorts of
8 technical concerns that may be associated with MPC
9 performance.

10 COMMISSIONER ROGERS: One of the
11 troublesome questions involving MPCs has been the
12 question of burnup credit. It's not only there, of
13 course, but I wonder to what extent you plan to do any
14 work in this area and do you have any special
15 facilities that might be suitable for burn-up credit
16 studies and criticality studies?

17 DOCTOR PATRICK: I will make a couple of
18 opening remarks and then defer to Bob. I know he's
19 like to comment on that subject as well.

20 We have certain facilities that are
21 available that could support such studies. At this
22 point, we've not identified any need for direct
23 studies of criticality to be done by our staff, have
24 not identified any particular issues there. Most of
25 those studies have been highly calculationally based.

1 We're familiar with those computer codes and I think
2 it is an area where some alternative calculations may
3 very well be appropriate to evaluate what the
4 Department of Energy is proposing with regard to those
5 criticality studies.
6 MR. BERNERO: There's an interesting
7 development here that affects the need or the desire
8 for such studies. For years people debated
9 criticality and burnup credit with respect to storage
10 in pools and transport, especially the transportation,
11 because transport for reasons of mass and bulk
12 optimizes at something the size of a railroad tank
13 car, which is a large assembly. We have traditionally
14 required the ingress of water, the ingress of
15 moderator in the safety review.
16 In this multi-purpose canister, however,
17 it is turning out, and I'm surprised by it, but it is
18 turning out that the need for burnup credit is not in
19 storage and transportation, it's in the disposal
20 phase. It apparently is the inability to predict in
21 the disposal phase that the material won't over a
22 period of thousands of years turn into a rubble which
23 might form a critical mass if moderator were present.
24 So, the concept of burnup credit may
25 actually be provided not by burnup credit but by some

1 means to prevent slumping, perhaps filling up the
2 assembly and getting some sort of homogeneous fill
3 instead of a void. So, right now it's not clear. DOE
4 has an extensive program already underway on how to
5 verify the burnup and monitor the burnup of the
6 assembly. But at the same time, they have studies in
7 their system process that will look to this long-range
8 issue of how predictable is it that I can keep this
9 material distributed the way it is to start with.
10 So, it's only on the burnup credit for
11 disposal that we're looking right now. So, it's not
12 clear what we need.
13 MR. THOMPSON: But I think our reliance on
14 the Center to do that effort right now, we have not
15 identified any specific need or support from the
16 Center on that particular issue, as I understand it.
17 COMMISSIONER REMICK: Well, would the
18 Center have expertise in criticality calculations
19 anyhow?
20 DOCTOR PATRICK: We have nuclear
21 engineering staff and mechanical engineering staff
22 that have worked in those sorts of problems in the
23 past.
24 COMMISSIONER REMICK: Incidentally, you've
25 done the best job in helping me better understand what

1 I characterized unjustly somewhat as some hand
2 wringing when people talk about the MPC and the
3 importance of the canister because I've always
4 thought, well, yes, we know there's got to be a
5 canister for the repository and that canister has to
6 be made to satisfy the conditions of the repository,
7 but I think your description makes me feel that that
8 decision on what is the canister might be driven by
9 the storage and transportation provisions and
10 therefore it could foreclose out possible design
11 features. And I must admit I had missed that. So, it
12 was very helpful to have your description.
13 DOCTOR PATRICK: A simplistic approach has
14 always been, well, it doesn't really much matter
15 because we can always over pack it again in something.
16 COMMISSIONER REMICK: Yes.
17 DOCTOR PATRICK: The focus has been on the
18 corrosion of the package, looking at 60.113
19 requirements. But looking internally to issues of
20 criticality and the like and looking externally to the
21 effect on the repository, that broader integrated view
22 is the point we were trying to make.
23 (Slide) If we could have the final slide,
24 slide 11.
25 I've tried to summarize here, choosing

1 from among the preceding materials that we've briefed
2 on, five particular items that I would offer as
3 central themes in the form of a summary or a
4 conclusion of what we've learned so far in the areas
5 that the Center and to a large extent the NRC staff is
6 focusing its attention on at this point. And you'll
7 notice a common theme in most all of these, that there
8 is a call for continued and productive DOE and NRC
9 interactions during this prelicensing period. We
10 think that looking at the congressional mandate of
11 processing a license application in three years is an
12 incredibly difficult task and that it's only going to
13 be through very productive prelicensing activities
14 that that's going to be likely to be successful.
15 Now, the first item there, as I had
16 indicated in one of the first charts, we have seen
17 over a period of years, as you're well aware,
18 continuing delays in the repository program without
19 commensurate slips. A couple processes that we
20 alluded to in several of the discussion points are so
21 complex, take such long periods of time to develop and
22 come to fruition that we feel it's -- we're getting
23 close to the point where unless there's some slip,
24 some movement in the license application submittal
25 date or some very clever approach to experimental

1 design that we've not tripped across, that there may
2 very well be some real impacts on the ability to
3 acquire the necessary data to license that site and
4 that repository.
5 We just finished talking about areas where
6 discussions need to continue with regard to
7 integration on MPC. I won't discuss that further.
8 Access to early site data is crucial and
9 staff has been working diligently to obtain access to
10 such data. Here we need access to that data to be
11 able to make sound judgments regarding not only site
12 suitability but the adequacy of the investigations
13 that the Department of Energy is currently working on,
14 currently planning. We find ourselves in positions of
15 reviewing one at a time, very detailed study plans.
16 But it's the data that begins to be acquired from the
17 early plans that gives us the real insights into the
18 adequacy of subsequent plans and the plans taken as a
19 composite.
20 COMMISSIONER ROGERS: Do we have a
21 mechanism for that to happen?
22 DOCTOR PATRICK: Yes.
23 COMMISSIONER ROGERS: Is there a clear
24 mechanism for data from the site to be able to --
25 MR. BERNERO: Oh, yes. We have --

1 COMMISSIONER ROGERS: -- go to the Center?

2 MR. BERNERO: Yes, we have that. We have

3 an agreement with DOE under which -- you know,

4 protocol, under which there is data access and then,

5 of course, the state gets access to the data as well.

6 DOCTOR PATRICK: And then the final two

7 items I would mention are key technical issues that

8 we're examining, infiltration, the movement of

9 groundwater from the point of precipitation down

10 through to the repository level and on down to the

11 accessible environment and then the potential for the

12 probability of the consequences of renewed volcanism

13 at the Yucca Mountain site.

14 Those conclude our remarks. I'd be happy

15 to entertain any additional questions that you might

16 have.

17 CHAIRMAN SELIN: I need to leave.

18 Commissioner Rogers will chair the meeting. Thank

19 you.

20 COMMISSIONER ROGERS: Commissioner Remick?

21 COMMISSIONER REMICK: Well, I do have two

22 questions, but first let me say that I continue to be

23 very pleased by the technical work of the Center. I'm

24 also very pleased at what I perceive is a close

25 interaction between the NRC staff and the Center

1 staff. I think it's a very powerful combination where
2 you folks, in somewhat of isolation from the day to
3 day problems that the staff faces, the crises they
4 face and so forth, can think about these things on a
5 more extended and in-depth. And yet the staff brings
6 with them the realism of the regulatory process and
7 their experience and so forth. So, it's extremely
8 powerful combination and I'm pleased to see how I
9 perceive it to be growing.
10 That brings me to a point. In my past
11 history, I had advisory committees or review
12 committees that reported to me on institutes and
13 centers that I was responsible for and I served on a
14 number of those. I know in addition to the advice you
15 get from review committees or reviews, in addition to
16 that is the fact that the people being reviewed, the
17 Center in this case, benefits too from time to time
18 having to sit back and analyze what it is you're
19 doing, what you've accomplished, what you haven't and
20 where you're headed in order so you can tell the
21 review groups.
22 When I look at reviews you've received in
23 the last half year or so, I see that in December, I
24 guess, you had the semiannual review of the staff for
25 about three days, immediately followed by our Nuclear

1 Research Committee, review committee, for several
2 days. I assume some of the same topics. I think
3 before that you had the Center for Nuclear Waste --
4 Advisory Committee on Nuclear Waste, excuse me, review
5 and now you have this one. Although I know reviews
6 are good, I wonder if we're not killing you with a
7 good thing.
8 MR. BERNERO: Excuse me, Commissioner.
9 You forgot the IG review.
10 COMMISSIONER REMICK: That's one question.
11 The other question is along that line.
12 Have you and the staff thought about is there any way
13 that we can combine some of these? In fact, I look
14 around and I see some of our NRC staff in the audience
15 and I think that's great. This is a one hour
16 presentation, but chances are our NRC staff here who
17 don't get an opportunity to go down for the six month
18 review and so forth and hear your presentations in
19 detail and perhaps even have an opportunity to ask you
20 questions, if you've given a thought about somehow
21 combining some of these and maybe holding your six
22 month review, which I guess is going to become an
23 annual review, sometimes in Washington where more of
24 our NRC staff could attend and participate?
25 I realize that probably means bringing a

1 number of people to Washington, but if you coupled it
2 with a presentation to the Commission and so forth,
3 maybe it could be justified and maybe we could
4 minimize the number of reviews on the assumption,
5 making the assumption that that's quite a few reviews
6 for a small group to be constantly regurgitating some
7 of the same information.
8 DOCTOR PATRICK: Those are some very good
9 suggestions and we have begun an analysis. For lack
10 of a better term we call it a zero-based management
11 initiative under NRC's program management leadership
12 to examine such things. Not just the review groups,
13 but the variety of other means and techniques that are
14 used to monitor, document our progress, record problem
15 areas, lead to their resolution and so forth.
16 But there are a number of constraints that
17 operate on our trying to combine some of these things.
18 The federal advisory committees prefer to meet alone.
19 They don't mind observers, but a typical advisory
20 committee meeting does not lend itself to staff
21 interaction. We took the first step this year to see
22 if moving two reviews together in time, if not in an
23 overlapping sense at least to abut them end to end, if
24 there would be some efficiency gained in the process
25 of doing that, and I think there was. Our staff was

1 able to basically prepare once. Even though the
2 audiences were somewhat different, we were able to
3 prepare once and provide adequate information, we
4 felt, to meet the purposes of both of those
5 organizations.
6 We are specifically looking at a
7 modification to the existing review structure which we
8 think will incorporate several of the suggestions that
9 you've made. In tandem with our consideration of
10 going from semi-annual reviews to annual reviews by
11 senior NRC management, we would space throughout the
12 year more focused program area reviews which would
13 most likely be hosted here at White Flint and would
14 allow more of your technical staff, in addition to the
15 management staff, to participate in those. So, for
16 instance, we would have an engineered barrier systems
17 program area review which would span NMSS work and
18 Research, and that could be given here and in a period
19 of a couple of days be able to go into great detail on
20 accomplishments, problem areas, new directions and so
21 forth.
22 I think they're good suggestions.
23 COMMISSIONER REMICK: And I think this
24 would encourage the team approach.
25 DOCTOR PATRICK: Absolutely.

1 MR. BERNERO: Yes.

2 COMMISSIONER REMICK: Where more of our
3 staff would be familiar with the Center and their
4 personnel and what they're doing and vice versa.

5 DOCTOR PATRICK: Absolutely.

6 COMMISSIONER REMICK: Thank you.

7 That's all I have.

8 COMMISSIONER ROGERS: Commissioner de
9 Planque?

10 COMMISSIONER de PLANQUE: Well, I'd like
11 to thank you for the excellent briefing. I always
12 find these extremely interesting. I especially
13 appreciate it when you do give us some results. You
14 know, we're always intrigued with why you're doing a
15 certain thing, but everybody leads us up to the end
16 point and we never hear the answer. So, it's really
17 wonderful when you can sprinkle in some of the
18 concrete results that come out of the research. We
19 appreciate that.

20 I have one question. It's probably mainly
21 for Mr. Bernero, but may require a reply on your part
22 as well.

23 I noticed from the budget document that
24 there's some plans to shift some of the work that was
25 more traditionally done here to the Center. Is that

1 going to just change the priorities at the Center or
2 is it going to require more manpower at the Center?
3 MR. BERNERO: No, the Center work is
4 planned around a core professional staff of 54 and the
5 budget projections we have right now, I'm thinking in
6 terms of the '95 budget. We won't be having any
7 significant change in the Center priorities and the
8 nature of their work.
9 COMMISSIONER de PLANQUE: Okay. What
10 about in terms of --
11 MR. BERNERO: Other than driven by the
12 program. Remember, we're in a phase of the DOE
13 program where the reactive data phase is really
14 building up, depending on the budget that DOE gets, of
15 course.
16 COMMISSIONER de PLANQUE: Yes. But in
17 terms of review of DOE documentation and reports, that
18 sort of thing, is there any shift in that?
19 MR. BERNERO: Nothing very significant in
20 my mind.
21 COMMISSIONER de PLANQUE: Okay. All
22 right. That's all I have. Thank you very much.
23 COMMISSIONER REMICK: Incidentally, along
24 that line, I'd like to say I appreciated your pretty
25 pictures also. I look at our own staff and it would

1 be nice if from time to time you thought of ways in
2 your presentations to show us some pretty pictures of
3 equipment or what you're doing.
4 MR. BERNERO: I'll bring the radioactive
5 material right here and put it on the table, except
6 that Sam Chilk would have a fit.
7 COMMISSIONER de PLANQUE: Glitz works
8 every time.
9 COMMISSIONER ROGERS: We've got to get the
10 print a little larger though.
11 DOCTOR PATRICK: Yes, I apologize for
12 that.
13 COMMISSIONER ROGERS: Well, I don't have
14 any special additional questions and I'd like to just
15 join my colleagues in thanking you very much for a
16 very informative briefing.
17 DOCTOR PATRICK: Thank you.
18 (Whereupon, at 2:38 p.m., the above-
19 entitled matter was concluded.)
20
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24
25

CERTIFICATE OF TRANSCRIBER

This is to certify that the attached events of a meeting of the United States Nuclear Regulatory Commission entitled:

TITLE OF MEETING: BRIEFING ON ACTIVITIES OF THE CENTER FOR NUCLEAR WASTE REGULATORY ANALYSIS (CNWRA)

PLACE OF MEETING: ROCKVILLE, MARYLAND

DATE OF MEETING: JANUARY 25, 1994

were transcribed by me. I further certify that said transcription is accurate and complete, to the best of my ability, and that the transcript is a true and accurate record of the foregoing events.

Carol Lynch

Reporter's name: Peter Lynch

CURRENT ISSUES IN THE HIGH-LEVEL WASTE PROGRAM

Center for Nuclear Waste Regulatory Analyses

January 25, 1994

Briefers: R. Bernero, NMSS
W. Patrick, CNWRA
B. Sagar, CNWRA
Contact: M. Knapp, NMSS
Phone: 504-3324

Slide 1

PURPOSE AND SCOPE OF PRESENTATION

- Provide a Summary Status of the CNWRA
- Delineate Basis for Selection of Issues
- Analyze Identified Issues
  -Statement of Issue
  -Progress to Date on Addressing Issue
  -Outlook and Plan for Resolution of Issue

BASIS FOR SELECTION: HLW PROGRAM ISSUES

- Systematic Regulatory Analyses
- Iterative Performance Assessment
- Prelicensing Interactions
- Development of Analytical Capabilities
- Research on Specific Topics

SELECTED TOPICS: HLW PROGRAM ISSUES

- Data and Models of Processes and Conditions
- Submodel and Model Validation
- Use of Early Site Characterization Data
- Use of Expert Judgment
- Subsystem and Total System Performance
- Multiple-Purpose Canister (MPC)

DATA AND MODELS OF PROCESSES AND CONDITIONS

- ISSUE
  - –Criteria to Judge Adequacy of Data and Sufficiency of Models
  - –Time to Make Such Determination
  - –Treatment of Multiple Alternative Interpretations

- PROGRESS
  - –Alternative Conceptual Models for Unsaturated Flow
  - –Evaluation of Importance of Coupled Processes
  - –Investigation of Tectonic and Volcanic Processes
    (A photograph of Crater Flat as seen from Yucca Mountain will be shown here.)
  - –Sensitivity Studies in Iterative Performance Assessment

- RESOLUTION
  - –Prelicensing Guidance/Interactions, F&CRG, and LARP
  - –Focus on Performance

SUBMODEL AND MODEL VALIDATION

- ISSUE
  - –Confidence in Models at Repository Time and Space Scales
  - –Distinction Between Model and Data Deficiencies

- PROGRESS
  - –Participation in INTRAVAL and DECOVALEX
  - –Study of Natural Analogs
    (A photograph of the Pena Blanca site exhibiting mineralization and fractures will be shown here.)
  - –Laboratory and Field Studies
  - –NRC/SKI Joint Paper on Model Validation

- RESOLUTION
  - –Manage Expectations; Scientific Validation not Possible
  - –Develop Technical Basis for Guidance

USE OF EARLY SITE CHARACTERIZATION DATA

- ISSUE
  - –NRC Inferences Regarding Adequacy and Suitability of Data
  - –DOE Use in Judging Site Adequacy and Modifying Strategies
  - –NRC Use to Review Repository and EBS Design

- PROGRESS
  - –Visualization of Structural Geology of Basin and Range
    (A Geographical Information System (GIS) image of the topography, faults, and earthquakes will be shown here.)
  - –Geochemistry and Hydrology of Death Valley Region
    (A GIS image of the topography, principal groundwater flow directions and the area and concentration of hydrologic investigations will be shown here.)
  - –Volcanism and Tectonism in Basin and Range

- RESOLUTION
  - –Policies and Procedures for Timely Access to Data
  - –Prioritize Analyses Based on Key Technical Uncertainties

USE OF EXPERT JUDGMENT

- ISSUE
  - –Acceptable Level of Subjective Data/Judgment
  - –Treatment of Diversity of Opinion
  - –Definition of an "Expert" for First-of-a-Kind Program

- PROGRESS
  - –Review of Current Practice
  - –Study of Use in Other Industries
  - –Elicitation on Future Climate at Yucca Mountain

- RESOLUTION
  - –Develop Technical Basis for Guidance
  - –Aid in Developing Public Confidence in Process

SUBSYSTEM AND TOTAL SYSTEM PERFORMANCE

- ISSUE
  - –Relationships Between Regulatory Requirements
  - –Acceptable Level of Detail in Modeling
  - –Use and Acceptability of Corroborating Evidence

- PROGRESS
  - –Systematic Regulatory Analysis to Develop Relationships
  - –Proposed Rulemakings and Guidance Documents
  - –Use of Iterative Performance Assessment

- RESOLUTION
  - –Complete Rulemakings and Guidance Development
  - –Focus Performance Assessments on Resolving Issues

MULTIPLE-PURPOSE CANISTERS

- ISSUE
  - –Potential Impacts of MPC on Repository Design and Performance
  - –Integration of MPC with Transportation, MRS, and Repository
  - –Compatibility of MPC with Thermal-Loading Alternatives

- PROGRESS
  - –MPC has Become DOE Preferred Concept
  - –Reviewed Regulatory Considerations Regarding MPC

- RESOLUTION
  - –Plan for Work on MPC But Assume High Uncertainty
  - –Foster Interactions with DOE on Technical Concerns and Integration Issues

CONCLUSION

- DOE/NRC INTERACTION ON LONG-TERM TESTING NEEDS AND POTENTIAL IMPACTS ON SCHEDULE

- DOE/NRC INTERACTION ON MPC REGARDING INTEGRATION AND TECHNICAL ISSUES

- ANALYSIS OF EARLY SITE DATA TO BE CONDUCTED ON AN ONGOING BASIS

- INVESTIGATION OF INFILTRATION
  - –DOE/NRC Interaction on Testing Program
  - –CNWRA Assessment

- AGGRESSIVE RESEARCH AND INTERACTIONS ON VOLCANISM
  - –Probability and Structural Controls
  - –Consequences