UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ANN RILEY & ASSOCIATES, LTD.
1250 I St., N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

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NUCLEAR REGULATORY COMMISSION

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PERIODIC MEETING WITH THE ADVISORY

COMMITTEE ON NUCLEAR WASTE (ACNW)

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PUBLIC MEETING

Nuclear Regulatory Commission

One White Flint North

Rockville, Maryland

Thursday, November 10, 1994

The Commission met in open session, pursuant to notice, at 2:30 p.m., Ivan Selin, Chairman, presiding.

COMMISSIONERS PRESENT:

IVAN SELIN, Chairman of the Commission

KENNETH C. ROGERS, Commissioner

E. GAIL de PLANQUE, Commissioner

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1250 I Street, N.W., Suite 300
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(202) 842-0034

STAFF SEATED AT THE COMMISSION TABLE:

JOHN C. HOYLE, Acting Secretary

MARTIN MALSCH, Office of the General Counsel

DR. MARTIN J. STEINDLER, Chairman, ACNW

DR. PAUL W. POMEROY, ACNW

DR. WILLIAM J. HINZE, ACNW

DR. B. JOHN GARRICK, ACNW

DR. JOHN T. LARKINS, Executive Director, ACNW

P R O C E E D I N G S

[2:30 p.m.]

CHAIRMAN SELIN: Good afternoon, ladies and gentlemen.

The Commission is meeting this afternoon the receive a briefing from our Advisory Committee on Nuclear Waste covering a variety of topics, including the Committee's recent letters on the impacts of DOE's program approach on NRC's high-level waste licensing activities. In other words, the impacts on our high-level waste licensing activities of the program approach, on the Committee's review of research activities supporting the high-level radioactive waste licensing program, and on the Committee's review of the staff's low-level waste performance assessment program.

The ACNW's discussion of DOE's program approach is the third of four scheduled briefings the Commission has had on various aspects of this topic. Obviously this is a very, very important topic to us.

In December, the Department of Energy's project manager will be here himself to provide the fourth briefing in this series, updating the Commission on the status of DOE's high-level waste program, including the new program approach. Our interest in this topic results from the recognition that successful resolution of the conundrum

associated with safe disposal of high-level radioactive waste is the key to maintaining nuclear power as a viable option in this country.

Before beginning the briefing, I would like to commend the Committee for its recent activities. The information provided to the Commission and to the staff in recent letters has really been right on target. The independent analyses provided by the Committee are becoming an increasingly important element to the Commission's deliberations on the high-level radioactive waste program and your ability to take a comprehensive overview in addition to the detailed pieces is really unique to us.

Commissioners?

COMMISSIONER ROGERS: No.

COMMISSIONER de PLANQUE: No.

CHAIRMAN SELIN: Dr. Steindler, if you'd like to start.

DR. STEINDLER: Well, thank you. We're certainly very pleased to be here. The changes that we've made have been made with the help of the Commissioners and we trust we'll be able to continue to be as useful as we should be.

We prepared a few points drawn from each of our recent reports and our current plan is to have each of our members address those topics on which they have been assigned the lead role. However, we can also expect to have

you jump in at any point and we will deviate as necessary and desirable.

We plan to --

CHAIRMAN SELIN: You state in that about as much a feeling of joy as there was in the Clinton statement yesterday, recognition of reality.

DR. STEINDLER: Well, aside from reality, but I believe it is probably more useful for both you and our members to have a discussion on things that are foremost on your mind than it is for us to explain at length the things that we've sometime already said.

The list that you have in front of you, however, was prepared under forced draft and taken some liberties with my fellow Committee members to put things in and take things out, which they've not had a chance to comment on. In addition, I think equally important, some of the answers to your questions may well be on topics that we've either not considered or not considered as a consensus operation. So, you may get individual comments from us on that basis.

But with that kind of a short introduction, if it's all right with you, let's just start on the front end of this thing. The first topic is our recent communication on the DOE proposed program approach.

We wrote a note which had two parts to it, if you'll recall. One of them was our perception of what the

program is. That turned out, as I'm sure you have also found, to be a slightly moving target. After we had written that, some of us attended a TRB meeting at which we learned some other things about the program. But nonetheless, from those four basic statements of what that program was all about, we extracted five conclusions that we wrote to you. We are prepared to at least make some comments about them. Let me start on one end.

One of the conclusions dealt with the impact of the PPA on the research program. The bounding assumptions that are likely to be required by the DOE, in order to assure that site suitability has been found and can be evaluated, is going to have to be addressed in some fashion or another by the NRC staff. This morning we had a short discussion with Mal Knapp on the mechanism of addressing that before the decision of DOE's goes to the President, if it goes to the President. They are in the process of looking at the process that they're going to go through in order to make some evaluations. We felt that the current approach to the research program tends to be oriented to numerical evaluations of parameters, which is not what we find in the performance assessment likely to be used in the absence of a significant amount of data. In fact, DOE has told us, and I think has told you, that bounding assumptions are going to be their key approach.

The research program is not currently organized to address the fundamental issue and the use of bounding assumptions. Namely, you have to understand the phenomenon that you're looking at in detail before the bounding assumptions make any sense. It's in that context that we simply identified the desirability of reexamining the research program to ensure that they're not worrying about the fourth decimal place of a parameter while not clarifying that total understanding of phenomena that really the staff needs in order to be able to do that. That's what we meant by that issue.

In addition to that, the schedule of the Department's is new and very compressed. The research schedules have not been tailored to that kind of a compressed DOE schedule.

CHAIRMAN SELIN: Are you talking about DOE's research program or our research --

DR. STEINDLER: Your research. The NRC research schedules tended to be, still are because PPA is new, tended to be operating on the schedule that is basically tailored to DOE's former approach. So, scheduling changes, which is really of significant upheaval in the research program, also will have to be looked at by the research folks. That's generally the tenure of our commentary on the research program.

CHAIRMAN SELIN: Let's go on the schedule and research a little more. I admit to being not at all clear as to what the program approach is. I'm pretty clear as to what the objectives are, reduced overhead, split-out suitability for licenseability question and all that, but the approach itself, I'm not so clear on. My impression is not just that they separate out the technical questions for suitability to address early from the ones for licensing to address later, but they don't address the ones for licensing. In other words, the research, for all intents and purposes, stops around 1998, the technical work. It's not just a question of reprioritizing our research program, it really is a question of compressing it considerably if we're to keep pace with the schedule that DOE has set. Is this right, wrong or does it miss the point?

DR. STEINDLER: My contention, and I'm going to let Bill comment on it in a minute, but my contention is that it is largely correct with one minor exception. That is we see the Department's research program that is designed to obtain data both on the site as well as the eventually defined, better defined than it is now, the engineered barrier system and the whole system design. We see that coming on well beyond the 1998 time schedule.

CHAIRMAN SELIN: Does DOE see it that way or are you predicting that they won't have --

DR. STEINDLER: DOE has told us that they see it that way. Understand that that's based on a relatively limited number of discussions with a limited number of people.

Bill, does that --

DR. HINZE: Yes, I think so. Another aspect of this, as an example, might be in terms of performance assessment, which we are all looking forward to as something to rely upon. That's based upon models and those models are based upon understanding processes. If the characterization or the study, the research has not been extensive enough to focus in on the right processes --

CHAIRMAN SELIN: DOE research, you're talking about?

DR. HINZE: The totality of the research, if you will. Certainly NRC must be concerned about what those processes are as part of the whole confirmation process. This means that your performance assessment. If you don't understand the processes, you don't have the correct models, this means that you are jeopardizing, putting at risk if you will, the performance assessment being a quality product unless you look at all of the extremes, and that may be where one has to be --

DR. STEINDLER: We want to come back to the whole issue of performance assessment.

CHAIRMAN SELIN: I guess you'll speak again about the system concept.

DR. STEINDLER: Yes.

CHAIRMAN SELIN: So we don't need to get into that.

DR. STEINDLER: Right.

DR. HINZE: I'm just using that as an example of how we really do need to understand some of the basic science, the processes, if you will.

DR. STEINDLER: We made the comment -- in addition to the issue on research, we made the comment that we thought that it was going to be difficult to evaluate the site suitability in the absence of a reference design. We continue to believe that that's an important issue. The Commission has a number of ways of -- if they agree, and I think the staff does, has a number of ways of managing that. But our recommendation would be to make it very clear to the Department that the kind of reference design that they're planning on may or may not be -- once that gets clarified, may or may not be adequate for the NRC staff to evaluate the product of the site suitability determination or high-level decision.

My own personal view is that I think eventually the Department will, in fact, provide you folks with a design, but at the moment that's not the direction in which

they're going. They may need a little more emphasis from the staff, communication from the staff that that is really a significant issue. Otherwise, it wasn't clear to us that the evaluation could be made sensibly.

We have spent a significant amount of time focusing our attention on various aspects of performance assessment, both in the area of the PPA, the new program approach of DOE's as well as various other aspects of the NRC --

CHAIRMAN SELIN: You're not going to say anything more about the design unless we provoke you to?

DR. STEINDLER: Why don't you provoke us.

CHAIRMAN SELIN: I just do not understand how one can make a suitability finding without being able to answer suitability for what. You know, it would be one thing if this were a perfectly benign site with no faults, no anything, but it clearly isn't. So, clearly the design is going to have to be to take advantage of the strengths and to avoid the weaknesses. On top of that, I'm getting the uncomfortable -- I'm not sure which of these two impressions I should believe. One is that what DOE is doing makes a lot of sense, but it's putting a terrific amount of pressure on us so that we're not the group that really slows things down. The second is it doesn't make as much sense because the research, although it might continue beyond '98, most of

the research will have to be done early and yet the application is going to be quite late because the application clearly has to have a detailed system concept in it.

So, my main concern at this point -- now, later on it might be different -- at this point is our research program. Later on I'm concerned about the situation that a future Commission will be in when we have the National Academy of Sciences, DOE, all of the high powered people in the country, your successors and our successors saying, "We're all ready to go and we don't know whether it's true or not, and at least slow things down." But right now I'm trying to figure out what the implications are for our research program and it just seems to be hurry up and wait, get a tremendous amount of work done quickly and then be stuck as the blanks get filled in.

DR. STEINDLER: Well, let's see if I can give you a comment. I guess I don't view the situation quite as bleak as you picture it. I can conceive of design aspects being at least defined from the standpoint of evaluation. Let me give you a for instance which in fact we raised with the DOE people and that is the aerial heat loading. Our question was how can you possibly worry about performance of a site unless you specify the aerial heat loading and how can you do that unless you have some kind of a design. The

answer was we're going to pick an aerial heat loading. We're going to see whether or not we can provide with that aerial heat loading arbitrarily selected, although it's not quite as arbitrary as it sounds, find whether or not the site is suitable, all other things being the same. If, in fact, we can find an aerial heat loading that's reasonable and find the site suitable, then we can say the site is suitable and worry about whether or not improvements in that aerial heat loading by change in design can be made to work at a later date.

So, if they pick 57 kilowatts per acre, which is our current baseline aerial heat loading, and they find that the site, all other things being equal, is suitable, they then have a touch point from which they can then take off and make improvements as the time goes on.

CHAIRMAN SELIN: And that aerial heat loading is dominant? In other words, it's not going to get worse than that as a tradeoff for some other parameter that also is going to be set --

DR. STEINDLER: That they can analyze later on. If you increased aerial heat loading, you've got a number of benefits but some detriments to worry about and that tradeoff study can be done later on, once they've determined what the aerial heat loading --

CHAIRMAN SELIN: I'm concerned that if you go

through all of these parameters that -- obviously you can come up with a design and achieve any one of the parameters, but can you feel comfortable that there exists at least one design that will achieve all of these parameters as they go through these simultaneously without doing a design?

DR. STEINDLER: I can't answer that question. There is the concern of the equivalent of common mode failure where you pick two parameters because you think the system will fly and that immediately obviates being able to put waste down there, for example. I don't think things are going to be quite that complex because I would guess that the number of parameters they have to pick for site suitability that relate to the engineered barrier system and the emplacement may be moderately limited. If that's the case, then I think they're at least able to overcome the driving need for a detailed design prior to 1998 or whenever they plan to start it. But that's speculation on our part, my part, and I have neither looked at what is required to make that site suitability study as it relates to the design of the repository itself, not the geology, nor do I have the chore of doing the site suitability. So, I don't know whether I can cover that part of the concern.

But I don't think it's quite as bad as that. I think the staff, the NRC staff has the same level of concerns you have and I suspect in the next few months Mal

Knapp and we are going to look at that system together to see whether or not there's anything there that really needs to be identified by way of design parameters before some reasonable progress can be made.

COMMISSIONER de PLANQUE: So, are you saying the number of parameters that would fall into the category of the aerial heat loading, for example, are probably limited and probably each one of those has a reasonable range and therefore the combination of ranges can be reasonably well characterized?

DR. STEINDLER: That's what I'm speculating.

COMMISSIONER de PLANQUE: That's what we're all hoping.

DR. STEINDLER: Yes.

CHAIRMAN SELIN: Why not have a rough design that meets these parameters to show that at least on the first cut -- I'm not talking about the details, on the first cut there exists at least one design that meets all of the simultaneously? I don't mean to put you on the spot, but it's really we who are concerned.

DR. STEINDLER: Frankly, it seems to me that from what one hears about what the DOE is planning, a portion of that design is already out. There are some uncertainties, but a portion of that design has already been -- has oozed out of the various discussions and comments and reports.

Horizontal emplacement of a shielded round canister that contains more than one subassembly, sealed and welded shut. The aerial heat loading issue comes up very quickly at that point because if you have a large multipurpose canister with 20 some odd PWRs, those are hot points. While you may have an average 57 kilowatts per acre, you don't have a detail of one. That does a lot of interesting things to rock mechanics and so on.

So, there are some interacting effects that I'm sure the Department has looked at, but I would guess that there are solutions at a minimal level of efficiency and perhaps a maximized economy which will allow the Department to say the site is suitable. Now, once having said that, they can now proceed with the process of trying to optimize, reduce the cost, et cetera, et cetera.

COMMISSIONER de PLANQUE: I would guess you essentially have a chicken and an egg problem --

DR. STEINDLER: Yes.

COMMISSIONER de PLANQUE: -- which needs an iteration. So, if you sort of close in on one, then you can close in on the other.

DR. STEINDLER: Exactly. So, that's my view.

Bill?

DR. HINZE: Well, I was going to say that you can't really design a repository until you have the geology

better specified if there are going to be setback distances, if we are going to know the characteristics of the faults in terms of their permeabilities. We have to find those things out before you can design a repository. So, what you have to do is you have to stay very flexible in terms of whether you have a single layer or duplex or just what. There are a number of options which DOE has under consideration.

But as you say, it's an iterative process. But until we get some of this information together, we're just not going to be able to come up with a design. But as I see it, what DOE is asking is is this basically a technically suitable site and that's what they're asking in the PPA. If it isn't, then one should move elsewhere.

CHAIRMAN SELIN: Please.

DR. STEINDLER: Well, let me move to the next point and that is, as I said, we've spent a fair amount of time on their performance assessment and its application under a variety of conditions and to a variety of problems. We looked at the role of performance assessment and the evaluation process that the NRC staff is going to have to go through and our conclusion was that there may be a significant difference in the way PA has been used in the past and the PA can be used in the new DOE program. John is our expert on the subject and so I'm going to ask him to comment on it.

CHAIRMAN SELIN: Good morning, Dr.

DR. GARRICK: Well, I have this strange belief that the less information you have, the more important it is to do performance assessment or risk assessment. While I've not convinced all my colleagues of the validity of that philosophy, we're making progress.

CHAIRMAN SELIN: It's also easier.

DR. STEINDLER: That's right, you're not confused.

DR. GARRICK: But I think that what it does require, as Marty has alluded to, is maybe to be more creative. So, I see the PPA as kind of an opportunity for the performance assessment people to come forward and demonstrate that they can provide the insight and the integration of information such that it's possible to see whether or not there's any hope of meeting this goal. When I talk about necessity for creativity, what I'm talking about is one of the reasons you do risk assessment and performance assessment is that you want to try to represent your current level of information realistically. Now, when you don't have much information, a realistic representation requires you to consider a range of possible outcomes or distributions.

So, while from the computational standpoint on the one hand, it introduces a slight complication. That is the complication of trying to embrace probability distributions

rather than single numbers. On the other hand, it does give you an opportunity to exercise the process and to begin to put the spotlight on where the greatest uncertainties exist and provide some near-term feedback that can guide not only the research program but the whole process of review.

So, I think that with the adoption of a little different perspective of how you set up your model and, of course, this brings us to a question that we'll come to a little later perhaps with the hope that you might be able to develop some simplistic models to give you some zero order approximations of where you are, I think that one of the aids that's very much important to us in dealing with the PPA is, in fact, performance assessment so performed.

DR. STEINDLER: Okay. Let me move on because I think we'll come back to performance assessment again.

One of the difficulties that arose almost immediately when DOE ventilated their view of PPA to us was that the lack of data or the absence of additional data which we had anticipated would come forward under the old program was going to force the Department to rely on expert judgment to fill holes where they hadn't been before. We've made comments about expert judgment for the last few years on this general area, but in this case it became obvious that that process was going to start very quickly. In the area of expert judgment there are a number of holes in the

protocols and guidelines, both that DOE is using as well as what the NRC is using. Paul is our expert judgment lead.

DR. POMEROY: Thanks, Marty.

COMMISSIONER de PLANQUE: We trust his expert judgment.

DR. STEINDLER: Well, we argue about it.

DR. POMEROY: Well, as you know, neither the DOE nor the NRC has published or implemented protocols regarding the elicitation of expert judgments and our letter basically recommended once again that the staff develop generic and detailed protocols for that elicitation. Those guidelines should involve not only the kinds of things we cited in Appendix B of our July 31st, 1991 letter, but it should also define acceptable methods of resolving some of the conflicts and uncertainties that will arise certainly and are going to be manifested in significant differences of opinion between groups of experts.

As you know, the NRC staff is developing some guidance on this subject. We plan to review that guidance in March, after it has gotten into a draft form. However, because we have fairly strong feelings and concerns on this subject and for reasons that I'll discuss in just a moment, we feel that we probably will provide you and the NRC staff with some thoughts on what should be in that draft guidance prior to the issuance of that draft guidance.

The second point I want to make is that the DOE has funded a major expert elicitation study to begin in fiscal year '95 on Yucca Mountain seismic hazard assessment. This is going to be, as I understand it, essentially modeled on the EPRI methodology that was developed for assessing seismic hazard in the eastern United States. That major undertaking, which is funded at a very high level, in my estimation, this year, will certainly involve a massive expert elicitation and if there are problems between the NRC's guidance and approach to what is acceptable to the staff in terms of expert judgment and what DOE is using within that seismic hazard assessment study, we feel it would behoove the staff and the DOE to talk to each other fairly soon about what is going to be acceptable in the way of expert judgment from the staff's standpoint and what the DOE plans specifically to do in terms of expert judgment.

In conversations with Mal Knapp and others, they recognize this problem and they plan indeed to have those conversations in the next several months, as I understand it. But it will -- that provides a sort of time frame, that seismic hazard assessment provides a time frame in which the NRC guidance will be critical. So, it's important that that guidance go forward.

The third thing I want to mention is that the National Academy of Science's peer review of the technical

basis documents is in itself a form of and utilization of expert judgment. One of our concerns is how DOE will address the comments from the Academy panels in the process of revising its technical basis documents. But we're also concerned about the question of how will the Academy's approval or disapproval of the technical basis documents be folded into the license application and how indeed will it effect how the staff looks at the problem? I gather from the presentation on October 31st to you by the staff, Mr. Bernero indicated that he had somewhat the same concerns. We don't have a solution to that problem because we don't quite understand how that Academy approval is going to be folded into the license application process, but we do have a concern that it may constrain in some way the review by the staff, although we've been assured, of course, that the staff will disregard it if necessary.

That's all I have on expert judgment. You will perhaps hear more about expert judgment in the course of our presentations on performance assessment.

COMMISSIONER de PLANQUE: Are you happy with the schedule as you see it now for getting to this point or would you like to see it accelerated even more in developing criteria and discussing with DOE and the whole package?

DR. POMEROY: I'm not sure what the schedule is for getting --

COMMISSIONER de PLANQUE: Well, you talked about March draft.

DR. POMEROY: If the draft in March and that is discussed in the March time frame with the Department of Energy. So, if the Department of Energy is clear what our requirements are and we can get a clearer picture of what their perspective is on what guidelines they're using, and I understand that we have some problems in that regard, I would be happy with that if it occurs in the March, April time frame. If it does not, then I would not be happy.

COMMISSIONER de PLANQUE: Are you expecting a lot of difficulty in coming up with this protocol and are you expecting DOE perhaps to differ quite a bit from what NRC might come up with? How difficult is this going to be?

DR. POMEROY: We are going to try to develop a generic statement of some of the things we think should be in that guidance document. That may in itself be difficult to achieve agreement among the four of us, but I think we can do that. I think there will be significant divergences between DOE and NRC and I think they should be resolved.

COMMISSIONER de PLANQUE: And probably the sooner the better because --

DR. POMEROY: Otherwise we're going to in some sense not effectively utilize a few million dollars of the taxpayers' money in the course of developing this seismic

hazard assessment.

COMMISSIONER de PLANQUE: It seems everybody knows we have to do this, but it isn't happening very fast and I can't sort out whether that's because it's extremely difficult to do or because the urgency hasn't been there or both.

DR. POMEROY: I think it must be because the urgency has not been there. Perhaps it's to some extent both. As you know, in the 1991 letter we advocated --

COMMISSIONER de PLANQUE: I know.

DR. POMEROY: -- that the staff develop guidance on this subject because we thought they could then. They probably could have then more easily than they can now, but that still may be possible to achieve some agreement with DOE as to exactly how expert judgment is going to be treated. Why it's been so slow, I don't have the answer to that one.

DR. STEINDLER: Let me make a couple comments. The original concern that we had was based on the general notion that the use of expert judgment in a licensing process ought to have its protocols and conflict resolution issues and all the other mechanisms set aside from the arguments that you get into in front of a licensing board. So, we were pushing fairly hard for rulemaking so that that issue at least would be set aside and not subjected to a

great deal of argumentation.

The other issue is the one that Commissioner Rogers raised, and that is is it, in fact, feasible to put together generically based protocols and conflict resolution procedures and all the other things that you need to have so as not to have to write a document for every subject matter in which you elicit expert judgment? We have not come to a conclusion on that last one, but I think some of us recognize that it's not a clear cut "no problem" type issue. But that doesn't prevent us from at least making an attempt and we have assigned Paul the great job of writing an internal talking paper for us on what that thing would look like on a generic basis to see whether or not it, in fact, can be done. It's that we're going to try and argue out among ourselves if we possibly can.

That doesn't answer your question particularly, but all I guess I'm saying is it could be difficult.

COMMISSIONER de PLANQUE: I get a better sense though from what you're saying.

DR. STEINDLER: All right. Well, if we can, let's leave the DOE PPA issue and turn to letters that concern the waste disposal research which we've looked at as part of a request by the Chairman to see whether or not we viewed the research program as sufficient and timely in response to the Commission's needs.

Bill Hinze is our lead on that and let me simply -- go ahead.

DR. HINZE: Okay. Thank you very much, Marty.

I will touch on a few of the general and specific items that are derived from our letter that deal with vulcanism, tectonics and natural analogs that we reviewed. These were selected for quite different reasons. Vulcanism research or studies have been going on at the Yucca Mountain by the DOE for a decade or more. The Center has been involved in vulcanism research for a couple of years. So, it seems appropriate that vulcanism is really on a fast track to try to reach some kind of resolution.

In contrast to that, tectonics, which deals with both past and present dynamical processes which set up the geological system for a number of other processes including the hydrologic properties, the integrity of the site and so forth, has been on somewhat a slower procedures. Finally, natural analogs were selected because of the concern by many around this table about the relevancy of the natural analog problem. Our bottom line to our letter is that the research in these three areas, based upon the criteria that Marty suggested, that the research deserves continued strong support. In fact, this Committee was very supportive of starting the vulcanism and tectonics research in the NRC. They are generally relevant and sufficient. We do have

concerns about timeliness and that concern was there even before the PPA and the PPA just exacerbates the other situation.

I think I must acknowledge the fact that we're pleased with a very positive reaction that we received from the recent EDO letter and from the staff on our various concerns and recommendations. Some specific things. In terms of relevancy, relevancy is a very difficult thing to establish in the area of geosciences as it applies to natural analogs because of the uncertainties in the initial and also the boundering conditions and how it really does compare or correlate with the site that you're comparing it to, the proposed high-level waste site. We believe that relevancy can only be -- these problems of relevancy can only be dispelled by tying the research priorities and the data acquisition aspects of it directly to the regulatory requirements and the licensing problems.

That brings us to a major recommendation of ours, that the problem of relevancy can at least be approached by an integration of the analog studies with the PA, with the performance assessment. We believe that this integration is something that has not been adequately addressed. We note, however, and we're very pleased with the fact that the center and the research staff held a recent meeting on performance assessment and the geochemical analogs. We very

much encourage similar types of working group meetings, of connecting PA with these analogs in other areas.

I should also point out that analog studies can be expensive and they can be very time consuming. They may not be always the most efficient method by which we arrive at some of our decisions and come to fruition with our concerns. This is particularly true of some of the foreign, some of the international analogs which may not permit us to arrive at -- really tie-in with our own rules, with our own concerns about the licensing process. Therefore, we really do recommend that one spend some bit of time looking at the appropriateness of some of the international programs, and we've mentioned a couple of those in our letter.

In terms of vulcanism and tectonics research, as I mentioned, we feel that these address important concerns at Yucca Mountain. But again, these projects need to be brought to fruition. Particularly we are very much concerned that one develop in the very near term alternative models that can be tested and can be investigated for the various processes that are involved.

Regional vulcanism, for example, in the basin and ranges is very important, but it must be very closely tied to the appropriate level of detail. Here again these things must be looked at extremely carefully.

The analogs and vulcanism I've already said

something about. Coupled effects in vulcanism and tectonics is very important, but we also are encouraged by some of the work that's being done by the Center and the research in terms of tying these to hydrology, which is very important.

In terms of generic, we mention a number of generic items. Despite the fact that John has not twisted our arm on this too much, and I would consider this one of the more important things that came out of our review to date, is that the research should place greater emphasis upon the use of PA in deciding its research priorities. These really must be based upon a risk-based approach. We are convinced, and I too am convinced, that there is a close link between PA, between the identification of critical uncertainties and the effects of those uncertainties and also the definition of research priorities. Those three things, the PA, the uncertainties and their effects, and the research priorities go well together. They have to be worked together.

I won't dwell on it, but there are a number of other generic items. One is that we see that there are opportunities to utilize external research personnel to the center and many of the research areas. This brings a high degree of cost effectiveness, of flexibility to the program which is very desirable.

We also feel that communication -- we've come to you before with this, but communication continues to be a problem. RES really does need to make the results of the research readily available in a clear and concise way to NMSS and other players in the game. We also feel that the use of peer reviewed publications is very important and we are again pleased to see that there's an increase in efforts along those lines.

In summary, I would say that the research in these three areas deserves the continued support, but timeliness and the tie to performance uncertainties by way of performance assessment studies remain an important concern.

Certainly as we learn more about the PPA, it is very important for us to take this into consideration and the research priorities. I guess I should emphasize that our concerns about timeliness are there, but they were there even before PPA.

DR. STEINDLER: Let me just add to that. We've thus far looked at a very limited view of the research program. We're continuing that. This morning we heard from Bill Ott on the low-level waste research overview and we have scheduled ongoing looks at various facets of the research program to round out and amplify or bring up new issues of the kind Bill just mentioned as we work our way through the research program.

DR. HINZE: I should have said something about, Marty. One of our emphases in the near-term here is trying to look at the groundwater travel time concern. So, a major effort in our review of the research program is in the subsurface hydrology and we held this past month a working group meeting on the isotopic data of groundwater which very much gets to the point of trying to tie down how we can best work towards defining groundwater travel time and specifying it at Yucca Mountain.

DR. STEINDLER: The Department has indicated pretty clearly that groundwater hydrology and groundwater travel time is perhaps the highest priority near-term that they have in the PPA and it will become an important issue for the staff. That's one of the reasons we pick on it at this point in time.

Questions?

COMMISSIONER ROGERS: Well, a couple of observations.

One is that with the notion of doing bounding analyses to determine site suitability and perhaps even beyond that, it seems to me that Dr. Garrick's suggestion with respect to simplified models of performance assessment that provide an iterative approach presumably to greater and greater refinement as more and more information becomes available is very important. The question in my mind was

whether that couldn't be coupled into some analysis of the research program in terms of how far you have to go. The problem with research programs is always that you have lots of interesting things that start to turn up as you start studying these matters and the most creative and curious minds want to pursue those as far as possible. We have to find some way of cutting that off so we can move ahead when we have enough information to proceed but not necessarily all the information that a scholar would necessarily want to understand fully something.

I wondered if you'd have any thoughts with respect to how bounding analyses, the kinds of notions of simplified performance assessment models which could be built using bounding analyses could be used to in fact guide the use of natural analogs. Would natural analogs, for example, provide some of the data necessary for setting bounding analyses? Would they play a more useful role there? Maybe that's exactly how they're contemplated, I don't know. But it would seem to me that even if they don't model a site perfectly, they might provide you with some way of validating some bounds with which you feel comfortable so that you might be able to use natural analogs to provide additional data on setting bounds for bounding analyses and also whether the whole approach of a bounding analysis approach might not give you, give someone a new tool to use

in determining how far to go with the research programs, particularly in this area which looks to me like one that could be lined out forever and ever.

DR. HINZE: And the level of detail.

COMMISSIONER ROGERS: Yes.

DR. HINZE: Right.

COMMISSIONER ROGERS: And I think that's the worry that we all have, I think, that one wants to be able to know enough but that may not be as much as one could possibly know. Where do you make that cut? That's the tough question. Starting out with simple performance assessment models built around bounding analyses and then applying that concept iteratively to a research program and using all the information that you might have, particularly say from natural analogs, might be a way of bounding the research program. It seems to me that's one thing that we have to do. In the first place, if you're worried about timing and timeliness, unless you're pretty sure you know what you need -- how far you need to go, it's pretty hard to say when you've gotten to the end of what you need to do and to set up a schedule to get there.

So, it does seem to me that what I'm hearing so far from your thoughts here all fit together in my mind very nicely into an overall program. But I don't know that you see it that way at all.

The other comments are sort of a little detailed and maybe I might just raise those. Your August 24th letter, I don't know, I haven't gone back and measured all these things, but I think it may have been the longest letter that you've sent us on anything.

DR. HINZE: Sir, you should have seen it in its first draft.

COMMISSIONER ROGERS: It was an excellent letter. I thought it was terrific, but, you know, one has to gauge -- try to use these things as perhaps indicators of importance. Since your role is to tell us what's really important, if this is the longest letter you've sent us, do you think this is the thing that we ought to be focusing our attention on with the greatest intensity at this level? In other words, does the level of detail and the breadth of the August 24th letter indicate to us that these particular issues as they're described in the letter really ought to be essentially at the top of our agenda because there's so much in that letter, or did it just turn out that way?

DR. STEINDLER: Let me see whether I can at least address that point.

I would suggest that the assumption of size versus importance is not sufficient --

COMMISSIONER ROGERS: You can grade it by weighing?

DR. STEINDLER: You can weigh it, but the difficulty is that in some areas we have more trouble expressing ourselves than we do in others and maybe the research came on that line.

The other point was that we felt, unlike some of the other communications, that we needed to describe what we saw because we were only looking at a part of the research program and we wanted to be sure that you understood very clearly that we were quite -- you made a quite narrow focus for that particular discussion. Our generic comments were obtained largely from past experience, but to the most extent on what we saw and we had to describe that. In the future we will try and turn those into either two letters or something else.

There was, I think, however, an attempt to point out that there are significant issues in research. They were stimulated in part by the question that the Chairman asked. They were stimulated in another part by the somewhat, to us at least, provocative set of comments on research that were incorporated in the paper that you wrote. We will eventually get to responding to that particular paper when we can find some level of agreement among ourselves as to which direction that response ought to be. It isn't that we haven't thought about it, but we are not totally in one direction on the role of research.

But I would suggest that that may not be -- especially in light of the most recent events. Remember, this was written before the PPA was ventilated to us.

COMMISSIONER ROGERS: Yes. Well, that's another question.

DR. STEINDLER: And since this is a fast moving business apparently, strategic plans become out of date very quickly.

COMMISSIONER ROGERS: That was another question as to what you think of your letter in light of the new PPA.

DR. STEINDLER: Well, we tried to make some comments in the broad general sense in our PPA letter on that subject, but we probably won't be able to make specific comments on the topics addressed, vulcanism, tectonics and natural analogs, until we have a lot better idea of where DOE is going. We hope between ourselves and Mal Knapp's group we can find out what this thing is all about and put it in context.

COMMISSIONER ROGERS: Fine. Just a couple of really questions about whether you've seen any progress in some of your suggestions that you called for a key technical uncertainty integration review in 1994. The end of 1994 is approaching. Have you see any signs of any motion in that direction?

DR. HINZE: Yes, I think there's an appreciation,

if nothing else. There is an appreciation that the KTUs do need to be fine tuned, they do need to be made more detailed. This will indeed help us with the research priorities because it will be easier to relate the research priorities to a finer tuning of the KTUs and I think that that's appreciated by the staff, yes, sir.

COMMISSIONER ROGERS: Well, also, you had a paragraph on communication that had to do with communication with the Center and NRC, not with any other organization. I wonder if you've seen any signs of any steps that are improving what you perceive to be a communications problem.

DR. HINZE: I think there is a greater awareness of the need for peer reviewed publication in the Center and, in giving those scientists credit, they've been very busy in the last two years. I happen to be an editor and I happen to have a couple of their papers sitting on my desk at this time. So, I know they're making progress.

COMMISSIONER ROGERS: Well, one of the problems, it seems to me, that we have with respect to peer review publications is that the purposes for which our research is done may not be sufficiently deep, let's put it, for publication in a peer reviewed journal. May not. Might, might not. I can see that it may be that we can decide that we've gone far enough on something, but that really isn't enough to constitute a solid contribution to a peer reviewed

journal on that particular topic. It's been my suggestion to the people at the Center in the past that NRC and the people involved with overseeing the Center provide some running room for the researchers so that when they get to the point that we're happy with, but would say, "We'd be happy if you stopped right there and moved on to something else," but that might fall short of what the researcher really believes is necessary to complete a unit for a peer review journal, that we give them some running room on that, that they have the ability to spend a little bit more time finishing up something so it meets the requirements that a journal editor might impose on them for a really complete piece of work suitable for publication in that journal.

I wonder if you have any thoughts on whether that might be an impediment here.

DR. HINZE: Well, you're quite right, the journals are not interested in necessarily solving the Yucca Mountain problem, but they are interested in the generic science. It's my perception that there is room being given to the Center staff to do just that. From my personal conversations with them, that's the case.

DR. STEINDLER: Let me just add -- you were going to comment?

DR. POMEROY: Go ahead, if it's on that subject.

DR. STEINDLER: Yes, it's on that subject. That

subject, I think, needs to recognize that there are journals and there are journals. In those areas where fundamental basic concepts are not espoused at length in a particular piece of work that, for example, the Center might have done, there are a significant number of national and international journals in the area of what I would call applied waste management science. What we were urging was not necessarily a focus only on the most basic of the sciences, but the publication in some peer reviewed format somewhere within the international community. That's what we thought was lacking.

The sense that we have at the moment is that, number one, the Center and the research staff understood what we were saying to them, and two, that they were beginning to move in that general direction. We can come back three or six months from now and tell you what the record shows and to see whether or not there have been any improvements and we'd be pleased to do that. It's a little early from the time we wrote this thing to the present to be able to discern a program.

COMMISSIONER ROGERS: Yes. Right.

COMMISSIONER de PLANQUE: May I follow-up on that before you go back to the other one? Yes, I was surprised to see that and I was wondering have we inadvertently set up any artificial barriers to prevent people from carrying

their work to a peer reviewed journal? Is there something else that needs fixing other than just the awareness and the time?

DR. STEINDLER: I don't know what Bill would answer to that, but let me just comment that there is an enormous press of time. In many particularly applied areas, once somebody is done obtaining some particular parameter or understanding a particular variable, that's passed on to the modelers. You take your equipment and you move it aside and you move onto the next program because somebody else wants that next number very quickly. I have no doubt that the Center and all the other research organizations that are involved in NRC work are under significant pressures of that kind. If you don't give people that kind of breathing room you're talking about, it's very tough to alleviate that pressure. That's particularly true in what I would call applied work. Can you do something about it institutionally? Certainly, but it's expensive and then you wonder about the timeliness issue as the PPA, for example, comes and sits in front of the nose of the NMSS people They need support.

COMMISSIONER de PLANQUE: Will this interact in any way with the criteria down the line for expert judgment?

DR. STEINDLER: I don't doubt that it would in a sense, but I think it would interact more with the criteria

down the line saying, "Are the data any good?" That's the final determiner. The argument has been that referee journals qualify the quality of the information. I don't happen to share that view nearly so much as my editorial friend does on the end over there, but that's been the fundamental peer review carrot that's been held out. In that sense it does impinge on the quality of the defensibility of the process.

Paul?

DR. POMEROY: I just wanted to go back one moment to the KTU issue and to amplify on what Bill said, in the sense that I think our comments made it quite clear to management of NMSS that we wanted to see not only fine tuning but actual sharpening of the KTUs because at the moment in the old KTUs in any case those KTUs would allow you to do almost anything. You could find some KTU that would shelter any piece of work. We made that point clearly to the management and I believe that's been taken to heart. In talking with people since then, there's an active program going on to sharpen those. More sharply focused perhaps is a good set of words to apply to that.

DR. STEINDLER: A term with which we're very familiar.

COMMISSIONER ROGERS: You also commented that you thought that the communication between the NRC staff and the

DOE needed improvement. Have you see any signs of anything there, either in the right direction or the wrong direction?

DR. HINZE: Well, I haven't seen any and the contacts I make haven't indicated that. What's worrisome is that it's not only on a personal level but it's also, as far as I've been able to gather, also concerning the acquisition of data and data in readily useable formats from DOE. That's even more disturbing to me. You can't get stacks of hard copy and make any use of them. They have to be in some kind of form that you can operate upon and use them. There are some horror story types of things which exist on that. But we understand DOE is very busy too.

COMMISSIONER ROGERS: But that's how the big problems arose, when people were very busy and never got a chance to do things the right way.

DR. HINZE: Yes, sir.

DR. STEINDLER: Exactly right.

DR. HINZE: Many of us are concerned about the communication between DOE and NRC as a critical factor. Sharpening of their research priorities, it can help.

DR. STEINDLER: Let me just comment somewhat editorially. There are clearly two sides to this argument. We understand very clearly the NRC staff side because we've asked, we've prodded around to see what the system is. It's a little more difficult to understand the DOE side, but

there is a DOE side which some of us have seen from time to time wearing other hats and it's the reconciliation of those two concerns, those two sometimes diverse opinions that has not yet been done. I suspect it will have to be done as the pressure that PPA begins to impinge on both the agencies because they're going to have to work together much more rapidly if that schedule means anything.

Now, you can argue that the schedule doesn't mean much, it's yet one more of 14 schedules that people have put together in the last two decades, but that's not the issue. But it's going to have to get resolved in some fashion.

Anything further? Let me move on.

We have talked about and have increased our activity in the area of performance assessment. We have looked at a number of performance assessment capabilities. We have been asked specifically to determine whether or not there are adequate capabilities within the staff to handle this important role which gets more and more important as the program moves along and as the program is changed.

Paul was the original chair of our performance assessment activities and as John came on board there's been a transition made from Paul's responsibility to John in this area. John, I gather, is going to discuss the overall waste management PA approach and Paul will jump in, I think, at the low level --

DR. GARRICK: Yes. Let me first observe that the Committee has really been very pleased with the efforts of the NRC staff to establish its capability and an independent capability. We've also been very pleased at the ability they've shown to integrate that in with the whole process which indeed it is. It's a systems based way of attacking a problem.

One of the issues that we've discussed and that keeps coming up and that I've sort of been chartered with to get more specific about, which I am doing, is this issue of the feasibility of developing a more simplified model that has a more rapid turnaround. In my opinion, one of the real problems with the performance assessment activities, DOE, NRC, the contractors is the poor turnaround time. I think that the opportunity is too great for us not to try very hard to do something about that. My vision here is that the performance assessment activity be much more than assessment, that it be performance monitoring. I would like to think that when we have a meeting, at least once every two or three meetings, we start that meeting off with a framework that puts things in perspective as to where things are. Here's what we calculated last time and here was our uncertainty and here were the open issues and now here's where we are this time, and to begin to build a track or a trace of how this project is evolving from a compliance

standpoint, from a safety standpoint and I think that can be done and it's not being done.

Now, it is a very complex problem. You know, I'm accused of trying to draw an analogy between performance assessment and probabilistic risk assessment and I'm not ashamed of that. But I heard the same arguments in the early days of PRA. When we first built the big models, before the NRC really was in the act of probabilistic risk assessment, we built some very big models, level 3 models. One of the anxieties that evolved from that exercise was having to wait two or three years to be told where you stand. So, our clients confronted us very directly and said, "Can we do something about that? We'd like to only wait three to six months," and we did do something about it.

What we did about it was we said, "Well, we'll select a very select group of people. We'll go to the plant, we'll stay at the plant and build a first pass model and come back and exercise it and fine tune it a little bit and document it some and in six months we'll give a first pass set of results, and that was very successful. It was very successful in that it provided some genuine output that could be employed in the big model that was yet to come and provide some opportunity for being economical in the development of that model, and it also provided some

insights about other things like research and licensing issues and what have you.

So, to be sure, it's a different issue, a different kind of problem, but I'm not yet convinced that we can't do something similar to that in the performance assessment arena.

Now, one of the areas that I keep harping on, it's very important in allowing you to do a performance assessment when you have little information. Supporting my thesis that the less information you have the more important it is to do risk assessment or performance assessment is to adopt the point of view of embracing uncertainty in your analysis so that if indeed you have broad uncertainties in your input parameters, obviously you're going to have broad uncertainties in your output parameters. But at least if you've gone through the process you have assembled and thereby can disassemble these bottom line results into the drivers for these uncertainties and again aid the process and hopefully provide a basis for a more economic modeling exercise.

Now, as I say, we'll report back to you on that at a later date, but we are chartered to try to come to grips with that issue and see if we can't at least develop a first level spec on how you would go about doing that.

Now, I wanted to say something about the other

issue and that's the issue of quality of the analyses and how you control that. Other members of the Committee are very much involved in this and should jump in. But as you know, these models that are being generated are very large and they have associated with them a large number of computer programs. The question always exists how much confidence do we have in those codes, how representative are they of the phenomena that we're concerned about, and not only how representative are they of the phenomena that we're concerned about, how do we know there aren't some fundamental errors in the software itself. There are a lot of those kinds of questions and we haven't completely come to grips with that, but we have some ideas and we're trying to get more involved in figuring out how to address the modeling uncertainties, how to address the quality issue.

So, I think that when we have talked with the staff we've been very encouraged by the enthusiasm, the recognition that this is a real opportunity to aid the whole licensing process, to aid the whole assessment process of our state of knowledge about the repository and the submittals in behalf of the licensing process, and I think that we're also realizing how much of a problem it is and that it's not something we're going to do. A simpler approach to get to a simple model, as we all know, is to do a very complicated model, do it well, gain confidence in it

and then simplify that one. At least now you have a benchmark, you know pretty much what you can get with high confidence and you can see how your more simplified model can reproduce that.

But I don't think that's the only way to do it, and that's --

COMMISSIONER ROGERS: Well, you can do it the other way around.

DR. GARRICK: That's right.

COMMISSIONER ROGERS: Totally turn the process around.

DR. GARRICK: That's right, and that's what we're hopeful of being able to encourage and hopeful of being able to make a contribution to.

So, Paul, you may want to say a comment or two about the low-level waste performance assessment.

DR. POMEROY: Right. I'd like to just say a few things about it. First of all, you recognize that we evaluated at the same time both the low-level waste performance assessment and the branch technical position on low-level waste performance assessment. With regard to the capability itself, I don't think I need to say any more. We recognize the significant progress that the staff has made and under the new consolidation of the low-level waste and high-level waste performance assessment we see significant

advantages and significant improvements in the capability that's occurring.

I did want to mention that we are and remain concerned with the consistency with which performance assessment is applied among the agreement states and between the states and the NRC. For example, the branch technical position talks a great deal about the iterative nature of performance assessment and low-level waste. We concur with that and, in fact, encourage the staff to bring that more to the fore, yet I think I'm unaware of any of the current low-level waste facilities that have done any iterative performance assessments. Mostly it's something that is contracted out to a contractor, evaluated and judged to be suitable and then the contractor has finished his contract and --

COMMISSIONER ROGERS: Like at EIS.

DR. POMEROY: -- the capability is gone. Yes, precisely.

COMMISSIONER ROGERS: Yes.

DR. POMEROY: We don't think that that's the way it should be used, but we're concerned that that's the way it seems to be being used up to this point in time and we hope that perhaps the branch technical position, which we understand will also be out in March, March will be a big month, that perhaps that will encourage some of the states

to consider performance assessment in a more iterative manner.

We also wanted to make the point that there has been a programmatic decision not to proceed with field validation of our own PA modeling capabilities at low-level waste sites. Specifically what the staff will be doing is to use decommissioning licensing actions as a surrogate for the existing low-level waste sites. We understand the arguments there and we're sympathetic to the resource considerations. We, however, still believe that it may be possible at some of the existing sites to do some field testing of the low-level waste performance assessment capability that the staff now has and we would recommend that to whatever extent that can be done, consistent with the resource arguments that we have had extensive discussions about, that that be done if it can be.

COMMISSIONER ROGERS: Maybe we could find a state that's interested in doing it.

DR. POMEROY: If we could, that would be an excellent --

COMMISSIONER ROGERS: I mean they've got the site.

DR. POMEROY: I'm not sure what the reaction might be.

One other thing I wanted to point out was that in our letter we did encourage the use of probabilistic

analyses for low-level waste performance assessment. That may seem very strange to you as it does somewhat to us because we in general think that probabilistic approaches are extremely useful. However, there is some resistance to that from some of the states and we're pleased that the staff does agree with us with regard to the use of those techniques.

In general, we're very pleased with the low-level waste performance assessment capability of the staff and we look forward to reviewing the draft technical position to determine whether or not all the changes we've suggested actually will come to pass.

That's all I have on low-level waste.

DR. STEINDLER: Well, I think we're rapidly coming to the end of our allotted time. We'd be pleased to discuss any other subject or topic or question, to answer questions that you might have with what time we have.

CHAIRMAN SELIN: You have this interesting chart on groundwater dating methods.

DR. STEINDLER: Okay. Bill will be happy --

CHAIRMAN SELIN: Apparently it's a very difficult problem. We'll see you next year.

DR. STEINDLER: Yes.

DR. HINZE: It is a very difficult problem and that's one of the results of our working group meeting, but

it's also very true that the DOE is going to be relying on those isotopic dating methods to look at the groundwater travel time. The results to date are rather perplexing and, if you will, disturbing because there appear to be some very rapid flow, whether through fractures or through faults, and it's a different ball game than a simple matrix flow model which we knew would come about. But some of the measurements of the isotopic dates are very disturbing.

CHAIRMAN SELIN: I'm glad you brought this up, but for a different reason. I just don't understand when you have a situation like this which says averages aren't really very good, you have to get into the details, how you can evaluate a site suitability without knowing the waste method? What are you going to put where and how are you going to protect against these various points just seems to me to be basic to what you're doing, especially when you can't find a dominant solution, where you can't just let us say there's no problem anywhere, therefore there can't be any problem where you're going to put the waste.

DR. HINZE: We agree with you and I think most geoscientists would. The heterogeneity is of very grave concern.

DR. GARRICK: The only comment I would make on that is that information and knowledge about the site is a continuous thing. It isn't as if we suddenly are going to

go from a zero knowledge base to an adequate knowledge base to do all the analyses that are necessary to get a license. That's the point about the reference to performance assessment in the context of performance monitoring, is to track that knowledge with time and to have a logic engine that we can process that information and give us the updates and maybe we will find with a lot of energy and creativity that the PPA is not impossible if, in fact, we start looking at the outcomes that we're interested in, however uncertain they may be at this early date.

DR. POMEROY: Could I add something to that? We have seen, in fact, over the course of the last few years, an evolution in the modeling capability of the DOE so that when we've gone from a situation where we had an average situation to one in which we had seven vertical columns to one now where there is the beginnings, at least, of a very interesting three dimensional model with several hundred calls involved. That indeed in itself begins to demonstrate lateral flow problems, that probably were not at least capable of being modeled in the past. But we do have an evolving modeling capability and perhaps we can't use an average flux over the whole repository area, but we're beginning to have at least 100 or so smaller aerial divisions that we may be able to define more clearly what the problem is. I'm not sure that we'll find a solution.

DR. HINZE: As part of this process we are planning to develop a working group meeting on groundwater modeling and where we are today and where the DOE is, where NRC is and how these fit into the PA assessment.

CHAIRMAN SELIN: It's very clear that when Dr. Dreyfus comes before us we'll need a presentation very different in nature and detail than the last two. It's not really generalities anymore. There are a lot of specific questions. Maybe we ought to try to have the staff write him a letter before he comes over so we can lay out what these issues are, not just play 20 questions and try to happen to fall upon --

Commissioners?

DR. STEINDLER: It may very well be that the issue of groundwater travel time can't be as easily handled as my analogy with the aerial heat loading. There are some complicating factors in this particular area. We've had some interesting discussions among ourselves on the whole question of groundwater travel time and its relationship to the licensing process.

COMMISSIONER ROGERS: Yes. I just want to say first, overall I thought this was a wonderful presentation and I thought that your letters to us and your summary beforehand of things was very, very helpful. I had a feeling that you really are getting your arms around the

important problems here from our point of view, and I would really say it's been very useful to me and I'm quite sure to my fellow Commissioners.

I'd like to just simply say though that Dr. Garrick's suggestion with respect to a simplified model that allows you to tell exactly how you're evolving, how your knowledge is evolving, where were we, where are we now, it seems to me is absolutely essential for a project that's going to go -- is a multi-generational project. There are going to people who wind this up that maybe haven't been born yet. I don't know. They're not going to have the foggiest idea of what we've been thrashing around with here unless this is a clear evolutionary model of what has been going on. You know? You're going to have tons on documents. You're going to have all kinds of detailed studies of all kinds of special effects, but the bottom line question is going to be, where are we and how do you avoid this thing getting away from you? It's almost away from us now, I think.

It seems to me that the approach that Dr. Garrick has suggested probably should have been started in the very beginning, but there's no time like the present. I think that without some kind of an assessment of what do we really know about this situation, not how many schedules have we met or how many dollars have we spent or not spent, or how

much hardware have we bought or how many people have we added or subtracted, those are all irrelevant to the fundamental question, "When all is said and done, what do we know about this site and where can we go from here?"

I think that Dr. Dreyfus' new approach lends a kind of refreshing possibility to a new start on this and I personally would like to see whether we couldn't just continue to make noises that the country needs something like this in the way of knowing where it's at and it would seem to me that it might couple very nicely into his new program approach so that when his successor comes to somebody and explains why they should take seriously their state of affairs, that there's a record that makes some sense to them.

Right now, I don't think if you go back and try to collect a reasonable set of documents that it's possible to come to any conclusion about anything. There's bits and pieces of all kinds of things floating around. It's a great big junk shop. Some order has to be brought into this thing that allows a reasonable person, but not an expert, to be able to follow the evolution and I don't think that's possible today. I don't think that can be done today except to see how much money has been spent, and we all know that's terrible in terms of being able to weigh the money against the results.

So, I would certainly encourage you to -- this is just my own personal point of view. I certainly would encourage you to keep pushing in this direction because, to me, it's the only thing that's going to be salvation of people's mental health sometime down the road, to have something like this as a tool that says, "This is where we stood. This is what we knew. We started out with a simple model. The model was not adequate for the final result, but it was a model that we believed in because of its simplicity and then we let that grow and we did it in a controlled way." To me, it makes an awful lot of sense.

Furthermore, the argument in the paper here or the notes here that starting out with a small model that you really believe is a very valuable way for testing the bigger model that evolves. Whoever wants to build a huge computer model with a million lines of code in it that pops something out without some kind of a simple analysis, analytical, non-computer generated analysis that makes some sense? If that model can't give you the same result as your simple analytical calculation, there's probably something wrong with that big model. It's the life preserver that we've used for years in introducing computation into science.

You've always got to start out with fundamentals. For me, you start out with an analytical calculation that you believe in and a model that is okay for the situation

that you're trying to deal with and see how your computer results begin to make some sense. If you can't do that, you're in trouble. I just have this very uncomfortable feeling that we're not paying enough attention to it from that point of view and I'd really like to give my own strong personal endorsement to the point of view that Dr. Garrick has been espousing here.

COMMISSIONER de PLANQUE: I have no further questions or comments, but I would like to second Commissioner Rogers' appreciation for your letters and for the briefing. It's been very helpful.

CHAIRMAN SELIN: You have done nothing in the presentation to lead to my having a lower opinion than I did when we started. Thank you very much.

DR. STEINDLER: I'm pleased.

CHAIRMAN SELIN: Which was very high. Thank you very much.

[Whereupon, at 4:05 p.m., the above-entitled matter was concluded.]

CERTIFICATE

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

TITLE OF MEETING: PERIODIC MEETING WITH THE ADVISORY COMMITTEE ON NUCLEAR WASTE (ACNW) - PUBLIC MEETING

PLACE OF MEETING: Rockville, Maryland

DATE OF MEETING: Thursday, November 10, 1994

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: Carol Lynch

Reporter: Peter Lynch

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, D.C. 20555

November 2, 1994

MEMORANDUM TO: John C. Hoyle, Secretary
of the Commission

FROM: John T. Larkins, Executive Director
Advisory Committee on Nuclear Waste

SUBJECT: ACNW MEETING WITH THE NRC COMMISSIONERS ON NOVEMBER 10, 1994 - SCHEDULE/BACKGROUND INFORMATION

The ACNW is scheduled to meet with the NRC Commissioners on Thursday, November 10, 1994, between 2:30 and 4:00 P.M. at the Commission hearing room at OWFN, to discuss items of mutual interest, including the following. Background materials related to these items are attached.

1.	Introduction (NRC Chairman)	2:30 - 2:35 P.M.
2.	Impact of DOE's Proposed Program Approach (M. Steindler/P. Pomeroy) (ACNW report dtd. Sept. 30, 1994)	2:35 - 2:55 P.M.
3.	HLW Performance Assessment Program (J. Garrick) (ACNW report dtd. May 27, 1994)	2:55 - 3:15 P.M.
4.	Comments on High-Level Radioactive Waste Research Programs on Volcanism, Natural Analogs, and Tectonics (W. Hinze) (ACNW report dated August 24, 1994)	3:15 - 3:35 P.M.
5.	LLW Performance Assessment Program (P. Pomeroy/J. Garrick) (ACNW report dtd. June 3, 1994)	3:35 - 3:55 P.M.
6.	Additional Items (e.g., groundwater age dating techniques) (if time permits) Closing remarks	3:55 - 4:00 P.M.

Attachments:
As stated

cc: ACNW Members
ACNW Staff

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, D.C. 20555

September 30, 1994

The Honorable Ivan Selin
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Chairman Selin:

SUBJECT: GENERAL COMMENTS ON THE IMPACT OF THE DEPARTMENT OF ENERGY'S PROPOSED PROGRAM APPROACH ON THE NRC'S HIGH-LEVEL RADIOACTIVE WASTE LICENSING ACTIVITIES

The Advisory Committee on Nuclear Waste (ACNW) has reviewed information on the Department of Energy's (DOE) Proposed Program Approach (PPA). This subject was discussed during our 66th and 67th meetings and included presentations by staff members of the NRC and DOE. The information obtained from the DOE and the NRC staff was supplemented by draft documents and responses to specific questions posed in writing to DOE by other organizations such as the Nuclear Waste Technical Review Board. This letter provides general comments on the broad outlines of the PPA program as we understand it.

DOE's PPA for the Yucca Mountain area will result in a change of the scope of the repository program to closely match the level of funding and the expected schedules for this program. In general, the Committee is impressed with the objectives of the PPA and in particular with the site characterization process that sharply focuses on the most important issues for site suitability and licensing.

The DOE PPA has not been fully exposed or developed but currently reveals the following attributes.

1. The program seeks to reduce the near-term site characterization studies to a level sufficient to make general findings on the site suitability that can be used to make a recommendation to the President about a repository at Yucca Mountain.

2. In the absence of comprehensive data and model development, DOE plans to use bounding assumptions to bracket the missing data but still allow site suitability findings to be made. It appears that the development and application of models will be based on these assumptions and that estimates necessary for the high-level findings by DOE (i.e., that no significant changes in the "outcome" of the models are expected after

additional data are obtained) will be based on the results of the use of bounding assumptions.

3. The DOE site characterization process will appropriately involve the qualifiers and disqualifiers in 10 CFR Part 960. The NRC regulations concerning siting (10 CFR 60.122) will not play a direct role in forming the conclusions derived by DOE about the site qualification. Present indications are that DOE plans to proceed with site qualification substantially without compelling input from the NRC staff, but DOE has indicated its intent to keep the NRC staff fully informed. Nonetheless, NRC, according to the Nuclear Waste Policy Act, is to provide preliminary comments on the sufficiency of DOE's waste form proposal and at-depth site characterization analysis when DOE recommends a repository site to the President. The protocols for resolving conflicts that arise as a result of this process are not clear.

4. DOE plans to use external peer review panels and is currently negotiating with the National Academy of Sciences (NAS) to organize these panels. The panels are to be assigned to review the technical merits of conclusions formulated from bounding assumptions and codified into topical reports. Whether such reviews may constrain subsequent regulatory actions of the NRC staff is not clear.

We believe that the PPA will substantially affect the activities of the NRC staff and may require changes in focus, schedules, and effort levels. Some of the considerations are as follows.

1. The planned reduction of data acquisition and the accelerated schedule for the submission of an application for a construction authorization following the determination of the suitability of the site as a repository will require greatly increased reliance on the use of expert judgment to support the models used for a description of the performance of the site. In addition, the planned use in the PPA of bounding assumptions when data are not available also places great reliance on the use of expert judgments as the source of estimates for the parameters necessary for the models. Neither the DOE nor the NRC staff has published or implemented validated protocols for the elicitation of such judgments. The site suitability process is developing information that will also be used in the preparation of the license application. We recommend that the NRC staff expeditiously develop generic and detailed protocols for the elicitation of expert judgments. The staff should develop guidelines or even more compelling documents that define acceptable methods of resolving conflicts and uncertainties that arise during the elicitation of expert judgments and are manifested in significant divergences in the resulting estimates.

2. Results from the PPA will be utilized in the license application (LA) for construction authorization which is to be submitted to the NRC once the site has been certified by DOE to be suitable for a repository. Although DOE apparently intends to continue to acquire site-related data after the submittal of the LA, the planned use of bounding assumptions will place new and significant burdens on the NRC staff in its review of the LA. The Committee recommends that the role of the high-level radioactive waste (HLW) research program be significantly modified to concentrate on the need to support the NRC staff in the evaluation of the quality, sufficiency, and appropriateness of the assumptions introduced into models in lieu of results derived from data. We recommend that the entire HLW research program be reevaluated and additional resources allocated to ensure that the projects in the program are sharply focused, planned for timely completion, and the scope is sufficiently narrowed to bear directly on information necessary to qualify the model assumptions used by DOE. Similar concerns are appropriate for the technical assistance program.

3. A part of the PPA plan is the use of and reliance on a more robust waste package (i.e., multipurpose canisters with appropriate overpacks) than had been heretofore planned. It is also likely that the LA will be submitted in the absence of a detailed design for the rest of the engineered barrier system (EBS) and much of the repository. Comprehensive information on the performance of the near- and far-field geology in the retardation of radionuclide transport may also be lacking. We believe that the NRC staff should be alert to and prepared to comment on a possible reduction in the reliance on the defense-in-depth approach, which is an important part of the regulatory philosophy for the HLW program. Although we do not believe that the overall safety of the repository needs to be compromised by changes in approach to the defense-in-depth philosophy, the NRC staff should be prepared to defend in regulatory terms its adherence to the original philosophy should it decide to do so.

4. Owing to the close relationship between the repository design (including the design of the EBS) and the performance of the repository system under the full range of likely scenarios, we recommend that NRC strongly urge DOE to prepare, at a significantly accelerated schedule, a reference design of the repository system. This should include, but not be limited to, information on the expected areal heat loading, details of the statistics and physical phenomena on which substantially complete containment is to be based, the use and efficacy of barriers to the migration of waste constituents, the planned geometry and disposition of the waste packages, and the control of processes that could lead to the dispersion of

gaseous waste components. Such a reference design should become available at the earliest possible time but at least before the initial high-level decisions about any of the Part 960 technical guidelines are completed. In the absence of such a design, NRC should convey to DOE its concern about its ability to evaluate the quality of the lower level decisions on any topic pertinent to site qualification.

5. The use of performance assessment (PA) has been fundamental for evaluating the significance of selected phenomena and scenarios and evaluating if the planned repository would meet regulatory requirements. However, the PPA makes it difficult to ensure that PA can be applied in the future in a meaningful manner, particularly since some of the phenomena that are expected to affect the repository will not be sufficiently explored to provide assurance that the basic physical processes are known, pertinent data have not been obtained, or models developed. We recommend that the NRC staff reexamine the role of PA and the development of PA procedures under these circumstances and prepare plans to supplement reviews of the PA results with more sharply focused inquiry into the bases of conclusions reached about the performance of the site.

As more detailed information becomes available (e.g., the DOE five-year plan and the technical implementation plans) for our review, we plan to supplement this letter with additional discussions and more detailed comments. In addition, the Committee will consider the question of issue resolution at a later time.

Sincerely,

Martin J. Steindler
Chairman

References:

1. Preliminary Draft dated 8/3/94, U.S. Department of Energy, Office of Civilian Radioactive Waste Management, "Process for Evaluating the Suitability of the Yucca Mountain Site for Development as a Repository for High-Level Radioactive Waste and Spent Nuclear Fuel"
2. Letter dated June 30, 1994, from Daniel A. Dreyfus, DOE, to Dr. John E. Cantlon, NWTRB. re: Department of Energy's response to the questions contained in the Nuclear Waste Technical Review Board's letter dated May 17, 1994

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, D.C. 20555

August 24, 1994

The Honorable Ivan Selin
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Chairman Selin:

SUBJECT: COMMENTS ON HIGH-LEVEL RADIOACTIVE WASTE RESEARCH PROGRAMS ON VOLCANISM, NATURAL ANALOGS, AND TECTONICS

The purpose of this report is to communicate ACNW observations on three research programs of the Office of Nuclear Regulatory Research in high-level radioactive waste (HLW), namely volcanism, natural analogs, and tectonics. The Committee identified in its November 10, 1993 Program Plan the review of the HLW research program as a priority issue in its support of the Commission's responsibility to license the proposed Yucca Mountain repository. Subsequently, you asked the Committee to examine the relevancy, sufficiency, and timeliness of the HLW research program. This report is a limited review within the broader activity which we are currently conducting at your request. The Committee's review aims to determine the use of the research to the technical basis for regulatory guidance and evaluation of a license application for an underground high-level waste repository. We plan to review other areas in the HLW research program and report these findings to you.

During the past several months the Committee has been briefed by the staffs of the Office of Nuclear Regulatory Research (RES), the Office of Nuclear Material Safety and Safeguards (NMSS), the Center for Nuclear Waste Regulatory Analyses (CNWRA), the U.S. Department of Energy (DOE), and the State of Nevada on their current programs on volcanism, natural analogs, and tectonics. These three programs together receive over thirty percent of the current annual funding for NRC HLW research.

Based on our review and discussions, the Committee views the research programs on volcanism, natural analogs, and tectonics as generally relevant and supportive of the Commission's regulatory mission and sufficient for the intended purposes. Thus, research in these topics deserves continued strong support. Nonetheless, the Committee believes that volcanism and tectonics research should be focused on the application of results to performance assessment (PA) and accelerated toward usable results. The Committee believes the relevance of natural analog studies has not been firmly

established due to the lack, to date, of sufficient integration of natural analog data into PA analyses.

General Comments

As a result of the review to date, we make several comments that appear common to the research programs on volcanism, natural analogs, and tectonics.

1. Program Priorities

The manner in which RES establishes priorities for programmatic areas, as well as for specific projects within these areas, should be improved by use of a risk-based approach. Prioritization of research projects should be rooted in their relevance to the estimated frequencies and consequences and associated uncertainties of specific events or scenarios affecting the proposed repository. Performance assessment will be useful in this effort. The PA by NRC and DOE needs to be a major guiding force for bounding the scope of research issues and establishing relative priorities.

Specifically, it is not evident how PA is being used or contributes to identifying key technical uncertainties (KTUs), user needs, research activities, and those processes, parameters, and assumptions that are most critical to performance. The Committee found little evidence that the studies and associated data are directed at testing assumptions that significantly impact site performance. Making stronger connections between PA and research priorities would improve the relevance and sufficiency of the research program. For example, there are diverse volcanism research activities under way at the CNWRA involving eruption/consequence modeling, studies of volcanic centers, preparation of data bases, and development of probability models for volcanic disruption. These activities need to be prioritized, in part, by a closer linkage to the support or testing of critical assumptions in PA so as to provide timely and usable results.

We recognize quantitative results of PA have only recently become available. Nonetheless, we urge the NRC staff to factor, as quickly as possible, PA results into formulation of the KTUs before new user needs are defined. While we encourage a greater emphasis on use of PA in setting priorities, we caution the NRC staff against basing programmatic decisions solely on PA results, especially until the key PA uncertainties have been explicitly quantified.

The Committee expects to revisit the issue of research priorities and schedules once the DOE Proposed Program Approach (PPA) has been better described.

2. KTUs and User Needs

The Committee believes the NRC staff should expedite the process of fine-tuning the KTUs and clarifying user needs. The need to update user needs is extremely important, as those defined over four years ago are still the bases of current HLW research programs. The NRC staff is now in the process of using Systematic Regulatory Analysis (SRA) to develop its License Application Review Plan (LARP). As a part of the LARP development process, the staff has formulated KTUs for all relevant technical disciplines. While the SRA/LARP process is a welcomed improvement in defining user needs compared to the former, less structured approach, the NRC staff has not completed this process. Many of the KTUs have an excessively broad scope and need to be sharpened. Thus, it was difficult for the Committee to identify how research project objectives and tasks are to resolve specific KTUs.

The NRC staff has indicated that a KTU integration review will be performed in FY 1994. The Committee believes this is very important in prioritizing and refining details of the KTUs and developing new and revised user needs but is concerned that the schedule may be excessively ambitious unless near-term progress becomes evident. The Committee recommends that completion of the integration review and definition of new user needs be given high priority by NMSS. Recognizing that these activities are ongoing, the Committee sees an important opportunity for RES to examine the current relevancy of specific research tasks for both current and future activities, and refocus its research program in response to new user needs.

3. Integration of Research Activities

The interdependence or close coupling of processes under investigation at Yucca Mountain, such as volcanism and tectonics, or tectonics and hydrology, must be evaluated to assess overall repository performance. However, briefings by the NRC and CNWRA staffs did not identify mechanisms in place to bring about such integration.

The existing projects in tectonics and volcanism appear to be focused on understanding discrete processes, as opposed to the interdependency of processes and their relationship to the regional tectonic setting. While the RES staff described a project planned for the future entitled, "Modeling Mantle Dynamics," which is designed to integrate the major tasks in both volcanism and tectonics, the project plan for it will not be developed until FY 1995. We recommend that the required integration should be more rapidly and deliberately implemented.

4. Communication

The Committee has commented before on the need for improvement in communication. We recommend that the RES staff summarize more expeditiously the results of its as well as the CNWRA's research into usable products for NMSS and others. Furthermore, with a few notable exceptions, the research performed by the CNWRA is not widely distributed and generally is not subjected to close scrutiny and peer review by the knowledgeable scientific community. The Committee recommends that NMSS and RES ensure that the results of research completed by the CNWRA receive such peer attention. In addition, the Committee continues to view the communication between the NRC staff and the DOE as unsatisfactory and in need of significant improvement regarding timeliness and level of detail.

5. External Research Activities

The CNWRA and RES are urged to continue to take advantage of opportunities in the use of external personnel to conduct research that is not within the scope of expertise of in-house staff. Several examples of the use of this procedure by bringing research expertise and facilities to bear on specialized problems have shown the merits of the approach. We suggest that benefits of external involvement in HLW research, including cost effectiveness, development of innovative ideas, enhanced program flexibility, and access to research expertise and equipment, merit increased use by RES.

Specific Comments

The Committee is pleased that some research has already proven useful in the guidance of regulatory policies, as background for technical assistance to the NMSS staff, and to stimulate DOE to further its efforts in the volcanism area. The following comments are aimed at increasing the effectiveness of the research activities.

1. Volcanism--This research bears directly upon the regulatory issues of overall system performance (10 CFR 60.112) and a potentially adverse condition identified in 10 CFR 60.122(c)(15). Scenarios of concern involve both direct and indirect effects of magmas that may breach the surface or reach the near surface in the vicinity of the proposed repository at Yucca Mountain. The issues include both the probability of an igneous event in the Yucca Mountain region and the consequences.

NRC's volcanism research is aimed at gaining a better understanding of igneous processes to reduce uncertainty in estimating both the probability and consequences of magmatic

events. The results should lead to development of more reliable models that predict the probability of volcanic disruption and eruptive scenarios and consequences in terms of any eventual transport of radioactive materials to the biosphere. Although preliminary calculations suggest that the probability of volcanism at Yucca Mountain is very low over the next 10,000 years, continued research appears to be justified as the current PA results are based on limited models and data and do not incorporate coupled processes.

a. Having embarked upon a program to characterize volcanism in the Basin and Range province and to formulate volcanic models for the Yucca Mountain region, RES needs to bring critical aspects of this program to fruition. Specifically, RES needs to formulate expeditiously a set of alternative defensible volcanic and coupled tectonic models that can be used in probabilistic PA and to estimate magmatic effects. RES should continue to concentrate on those parts of the volcanic studies that achieve this goal and, if necessary, limit the overall scope of the program. For example, the Cerro Negro, Nicaragua and the Tolbachik, Russia volcanic analog studies may be of lower priority.

   In addition, the Basin and Range province project should not become mired in preparation of Geographic Information System (GIS) data bases, but data bases of an appropriate level of detail should be developed that will enable testing of models for the Yucca Mountain region. The level of detail required and how and when the data will be used should be well established. The NRC staff should have long-term plans for maintenance of and additions to the GIS data bases until they are supported by others.

b. The Field Volcanism project is wide ranging and appears to be open ended and lacks targets of application. The Committee recommends that the goals of the research, in terms of specific types and uses of data to be obtained, need to be more clearly defined, articulated and limited in the context of realistic expectations considering resources and timeliness.

c. The indirect effects of magmatism on waste canisters are of sufficient concern that the NRC staff should ensure that these effects are evaluated. The effects of magmatically driven hydrothermal circulation of solutions that may be affected by released volatiles are likely to be important. These effects appear to be readily amenable to modeling and laboratory testing. The Committee recommends that these issues be explicitly

evaluated as to their importance to the goals of the research program.

2. Natural Analogs--This research is directed at systems and processes in a field situation that are considered analogous to the Yucca Mountain geologic setting. This research takes advantage of the large scales, long time periods, and the many and complex interactions that characterize geologic systems. Such processes are difficult or impossible to duplicate in the laboratory.

   a. Relevancy of natural analog studies is difficult to ascertain because of uncertainties in the initial and boundary conditions of the analogs and complexities in interpretation due to coupled processes. This concern can be dispelled by developing research plans that are closely tied to achievement of regulatory and licensing goals. Furthermore, the data available in the natural setting are virtually infinite, and therefore care must be exercised in the choice of research parameters that are relevant to regulatory concerns. The Committee found that the direct connection between key regulatory uncertainties and data being collected at HLW natural analog sites is not obvious in all NRC projects. The Committee recommends that such nexus be specifically identified for all analog projects.

   b. Natural analog projects are often conducted and funded in cooperation with other nations. The geological setting of the projects may not be analogous to the Yucca Mountain site. While not negating the potential utility of such projects, the relevance may not be sufficient to warrant the expenditure of resources. The Committee recommends that the expectations and objectives of this type of research be better defined and used in prioritization.

   c. The use of natural analog data and interpretations in either quantitative PA or model validation needs to be carefully and precisely defined. The Committee is encouraged to learn that RES and CNWRA have recently conducted a workshop on the nexus between PA and geochemical natural analog research. The Committee recommends that this process also be applied to analogs in volcanism, tectonics, and other areas such as the results of ground water movement at the Apache Leap test site in Arizona.

3. Tectonics--This research is important in determining several potentially adverse conditions at the proposed Yucca Mountain repository site that involve seismicity, potentially signifi-

cant faults, movement of gases and surface waters, and ground water levels. In addition, the research provides an overall geologic framework needed to evaluate coupled processes and assess overall site performance.

Tectonics integrates a variety of geoscience disciplines to determine the past as well as present dynamic processes and their effect on the nature of the geologic setting. Understanding these processes requires a knowledge of the regional tectonic framework, far-field stresses and geologic events. The geologic structures resulting from the tectonic processes and the processes themselves impact the nature and integrity of a repository site in a variety of ways. Thus, this research is especially important to NRC's regulatory guidance and licensing concerns. The review of tectonics is exclusive of rock mechanics and seismic hazards.

a. The tectonics research program of the CNWRA has been in place for a relatively short period and has been largely directed toward literature review, data compilation, definition of research plans, and development and compilation of software for modeling and analysis. These preparatory tasks are completed or scheduled for completion by September 1994, at which point the program will be poised to address critical questions through data analysis and modeling. Tectonics provides the regional picture needed to evaluate other processes, and therefore the Committee recommends that RES accelerate the model development and analysis phase of the program. As a result, it may be necessary to limit the overall scope of tectonics research activities.

b. The Committee is pleased to see the tectonics research activities take on a regional viewpoint, but extension of the study area beyond the immediate structural province of the proposed Yucca Mountain repository site should only be done with clearly identified goals and strong justification which is currently not available.

c. The concerns expressed (as discussed in 1.a) regarding the appropriate level of detail, maintenance, and data types of GIS data bases are also applicable to the tectonic data bases.

d. In view of the continuing concern about the impact of faulting on the integrity of the Yucca Mountain site and about the role of faults in subsurface water movement, tectonics research needs to emphasize the understanding and effects of faults at Yucca Mountain and the nature of faults as a result of the evolution of the regional strain pattern over time. This goal was not apparent to

the Committee in the research plans. We recommend that RES ensure the relevance and sufficiency of the program by inclusion of such plans.

Summary

The Committee's major findings are summarized as follows:

- The research programs in areas of volcanism, natural analogs, and tectonics are generally relevant and supportive of the Commission's regulatory mission in HLW. The Committee supports continuation of HLW research in these areas. However, the HLW research program should be improved to make it more relevant and timely.

- RES should ensure that it has established well-defined, risk-based priorities for its programs. In addition, RES should develop a mechanism for establishing that those programs are required to support or test critical assumptions of Performance Assessments (PA) and Key Technical Uncertainties (KTUs). In particular, research efforts should be tied more closely to PA in an iterative manner so that assessing relative risk of a phenomenon becomes an explicit part of the research planning process.

- The current transition period when KTUs and user needs are being developed using Systematic Regulatory Analysis (SRA) is an excellent opportunity for RES to take a prominent leadership role in refocusing the research objectives in response to the new KTUs as well as potential changes in the DOE Yucca Mountain program.

- Integration between research projects that address discrete phenomena but are closely coupled, such as tectonics and volcanism needs to be strengthened to assess the overall performance of the proposed Yucca Mountain repository.

- More effective communication of research results within the NRC and with the larger scientific community is essential for the contemplated use of the program results.

- The benefits of research external to the CNWRA, such as cost effectiveness and availability of specialized research expertise and equipment, merit continued use of such projects by RES.

We are pleased to note that many of the points raised in this report are recognized by the parties involved in the HLW program. However, we believe action is warranted which will lead to improving the effectiveness and timeliness of the program. Future reports to the Commission will detail observations and recommenda-

tions on other specific HLW research programs that will serve to support and refine the general observations made herein.

Sincerely,

Martin J. Steindler
Chairman

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, D.C. 20555

June 3, 1994

The Honorable Ivan Selin
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Chairman Selin:

SUBJECT: REVIEW OF THE LOW-LEVEL RADIOACTIVE WASTE PERFORMANCE ASSESSMENT PROGRAM

The Advisory Committee on Nuclear Waste (ACNW) has developed and operates under a program plan which includes both identification and selection of issues pertinent to nuclear waste management and determination of priorities for the ACNW schedule of activities. Low-Level Radioactive Waste (LLW) Performance Assessment (PA) is specifically identified in the program plan for study by the Committee. This topic is addressed in terms of the activities and capability of the NRC staff and the relation to programs dealing with LLW. These considerations satisfy the Committee criteria for topic selection and prioritization.

The purpose of this letter is: (1) to provide to the Commission the results of the ACNW review of the NRC staff LLW PA program and (2) to provide comments to the Commission regarding the utility, focus and adequacy of the draft Branch Technical Position (BTP) on PA applied to LLW disposal. These evaluations are based on presentations by the NRC staff during the ACNW Working Group meeting held on March 22, 1994, and on discussions during the 62nd, 63rd, and 64th meetings of the Committee on March 24, 1994, April 21, 1994, and May 17-18, 1994, respectively.

A. Capability of the NRC Staff PA Program Applied to LLW Facilities

1. The Committee concluded that the NRC staff has a sound and functional understanding of the bases of comprehensive PAs. Further, it was apparent that the NRC staff members making the presentations were knowledgeable in their fields of specialty. The NRC staff appears to have the necessary resources (personnel, computer hardware and software, etc.) to carry out these assessments. The recent consolidation of the LLW and the High-Level Radioactive Waste (HLW) PA staffs should enhance these capabilities as long as the identity and continuity of experience of these teams are preserved.

2. The Committee recommends that the NRC staff seek ways to demonstrate that the PA results it obtains are in agreement with actual data obtained from sites which are sufficiently similar to those encountered in LLW disposal, to establish functional credibility of the NRC PA process and gain additional experience. Such a demonstration would lend additional credence to the presumption that the staff has the appropriate capability. Although such data are difficult to obtain, the benefits from such a demonstration are worthy of a significant effort.

3. The NRC staff is urged to develop a rational basis for the scope and depth of its required capability in performance assessment. Such a position should be submitted to the Commission for review and discussion. The capability requirements are different, depending on the role the staff may take. Clearly, the thrust should be the ability to review a PA for credibility and completeness.

4. The Committee believes that risk calculations from PA should be made using, to the extent feasible, dose models that are applied elsewhere in the NRC for such purposes. The presentations by the NRC staff indicated no such consistency.

5. The Committee agrees with, and strongly supports, the proposed use of probabilistic techniques in the PA process. These techniques are essential to capture uncertainty, to clearly delineate the current state of knowledge, and to serve as a guide to the acquisition of additional data.

B. Branch Technical Position

1. The revised draft BTP represents a significant improvement over the previous version, and the NRC staff should be commended for this effort.

2. The general approach to PA, as described in the BTP, reflects contemporary methods of analysis including the scenario based approach to risk assessment and the treatment of uncertainties.

3. The individual activities of PA are well articulated with respect to such areas as radionuclide transport, engineered barrier performance, source term definition, and dose assessment.

4. The draft BTP should be reviewed and, where necessary, revised to ensure that it is a generic document applicable to a variety of LLW disposal facility types. The draft version forwarded to the Committee for review requires

significant editing to remove prescriptive sections that are either arbitrarily devised or are based on predetermined, but not evident, concepts of an LLW disposal facility. The Committee believes that the bases for excluding from the BTP above-ground vaults and facilities deeper than 30m should be explicitly stated, and alternative sources of guidance to the reader need to be provided in a timely manner if these facilities are not discussed in this BTP.

5. We agree with the NRC staff's stated position that PA should adopt a "successive approximation" or "phased" or "iterative" approach. We were disappointed not to see this position more clearly visible in the document. Although the NRC staff alluded to starting PA during the early stages of an LLW disposal facility, this approach was not specifically noted. The Committee favors early application of PA as a means of measuring project progress with each iteration of the assessment and believes this should be reflected in the BTP.

6. The Committee believes that there is significant uncertainty about the required time frame for PA. The presently used arbitrary numerical values (e.g., 10,000y) lack bases in either standards or regulations. The Committee recommends that, as a minimum, the time frame for site-specific PA should be guided by the dose-time profile as depicted in the draft BTP and used in conjunction with an explicit upper time limit. The NRC staff is urged to develop a position on the appropriate time frame and submit it to the Commission for discussion, review, and approval.

7. The Committee believes that the process for elicitation of expert judgment in conjunction with the construction of a PA data base needs to be specified. The NRC staff recognizes the value of expert judgment but does not identify in the BTP specific acceptable processes of expert solicitation. More guidance for the reader of the BTP is needed on the process of transforming expert judgment into a form that is suitable for inclusion in the PA data base.

8. The Committee recommends that in those cases where the BTP describes PA results that have the benefit of uncertainty analyses, the performance indicators be presented accordingly to reflect the full state of knowledge of the results. Specifically, probability distribution functions should be presented rather than simply measurements of the central tendency of the results such as the mean or the median.

9. The draft BTP lists specific issues that are not to be included in the PA (e.g., global climate change) but fails to identify the criteria used to exclude these issues. The Committee recommends that such criteria rather than prescriptive specifics be provided to the reader.

We trust these comments and recommendations will be useful.

Sincerely,

Martin J. Steindler
Chairman

Reference:
U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, Draft Branch Technical Position on Performance Assessment for Low-Level Waste Disposal Facilities, January 1994

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, D.C. 20555

May 27, 1994

The Honorable Ivan Selin
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Chairman Selin:

SUBJECT: REVIEW OF THE HIGH-LEVEL RADIOACTIVE WASTE PERFORMANCE ASSESSMENT CAPABILITY OF THE NRC STAFF

In its November 10, 1993 Program Plan, the Advisory Committee on Nuclear Waste (ACNW) recognized the importance of Performance Assessment (PA) to the Commission's responsibilities related to licensing a high-level radioactive waste (HLW) repository. The purpose of this letter is to advise the Commission of the progress made by the NRC staff in developing a capability in high-level waste PA. The Committee is pleased with the progress as demonstrated in Phase 2 of the PA. This evaluation is based on presentations by the NRC staff during the ACNW Working Group meeting held on May 16, 1994, and on discussions during the 64th ACNW meeting held May 17-18, 1994. The following comments are provided:

1. The Committee was impressed with the progress the NRC staff has made in improving its PA capability including computer modeling. The improvements have been in most of the key areas where specific needs were identified in the ACNW letter of December 2, 1991. These needs included the detailing of program goals and means to achieve the goals, the upgrading of the NRC staff's computer hardware, resolution of limitations on key software and data, and assurance of adequate resources to meet future personnel and equipment needs as the PA program evolves.

2. With the completion of Phase 2 of the PA, the NRC staff has taken a major step forward in its capability to review effectively PAs submitted in support of DOE's prelicensing activities such as site characterization and for the licensing application. Despite the advances made by the NRC staff in HLW PA, the computer models and technical data base are not sufficiently developed to allow PA to serve as the exclusive basis for programmatic decisions. However, the PA, even in its present state, is still an indispensable aid in research, technical investigations and site characterization. The Phase 2 effort involved increased sophistication in model and

computer code development, the use of a much more mechanistic and detailed source term model and computer code, more refined modeling of flow and transport in both saturated and unsaturated media, the inclusion of seismic and magmatic disruptive scenarios, and the addition of a dose assessment capability. Specific improvements were observed in such areas as the structuring of scenarios, the treatment of uncertainties and, in Phase 2.5, the eliciting of expert judgment.

3. In order for the NRC staff to continue improving its PA capability, the Committee recommends the following actions:

- Continue to develop simple models that provide an efficient platform to test changes in parameters, subsystem modeling, quality of input data, etc., with respect to the impact on bottom-line results including release rates, dose calculations and health effects. Such models should accommodate the importance ranking of issues for different repository durations and performance indicators. Particular attention should be paid to the propagation of the full range of uncertainties and the transition from the complex to the simple model.

- There needs to be a continued effort to more clearly define the disposition of results obtained from expert judgment panels. The process for eliciting expert judgment was greatly improved during Phase 2.5 of the PA program. An acceptable process for implementing elicitation results by the NRC staff, as well as by the general regulatory community, remains uncertain. This Committee continues to advocate rulemaking on the elicitation and application of expert judgment in order to resolve this issue before submittal of the license application.

- The concept presented by the NRC staff of "confidence building" in the models as a process in model validation, while philosophically appealing, needs clarification with respect to its technical bases.

- The staff is encouraged to anticipate the need to compare performance assessment results between iterations and with other PA results. The comparison of results does not appear to be a major consideration in the performance assessment modeling strategy. The ability to make these comparisons greatly enhances the regulatory review process. In particular, the scoping of the PA needs to be such that the boundary conditions, logic models and parameter values are visible and easily changed. The

important benefit is the ability to efficiently benchmark the results with other assessments.

- There needs to be a clearer indication of how the method of successive approximations is applied to the screening process and the identification of "critical issues," i.e., those issues contributing to poor repository performance.

The Committee was pleased to hear of the NRC staff's increased interaction with other agencies, institutions, and especially with the international community.

4. In the NRC staff's PA Strategic Plan, the Committee urges the staff to:

   - clearly delineate tasks that should be completed to ensure a fully developed capability prior to receipt of a license application, and

   - complete the plan for prioritization of PA activities (including the development and weighting of criteria for prioritization) in order to ensure optimum utilization of resources in future PA activities.

The Committee considers a performance assessment capability as key to the carrying out of the regulatory responsibilities of the Commission. Properly performed, PA is essential to giving perspective to technical issues associated with the licensing of the HLW repository. The NRC staff has made impressive progress in improving its PA capability and the Committee recommends continued strong support to obtain results in a timely manner. The Committee intends to keep the Commission advised on the continuing progress to develop this capability.

Sincerely,

Martin J. Steindler
Chairman

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, D.C. 20555

November 9, 1994

MEMORANDUM TO: The Commission

FROM: John T. Larkins, Executive Director
Advisory Committee on Nuclear Waste

SUBJECT: PRESENTATION HANDOUTS FOR THE NOVEMBER 10, 1994 BRIEFING OF THE COMMISSION BY THE ADVISORY COMMITTEE ON NUCLEAR WASTE

The attached briefing handouts are provided as an aid for the periodic Advisory Committee on Nuclear Waste (ACNW) discussion with the Commission. The ACNW has recently forwarded several letter reports to the Commission that can serve as the basis for the discussions at the meeting between the ACNW and the Commission. The ACNW believes the following topics to be important to discuss further during the meeting with the Commissioners. In addition, the ACNW expects to respond to questions and issues raised by individual Commissioners. The full Committee has not had an opportunity to develop these topics. It is likely that the topics will be augmented or reduced as the meeting progresses.

Attachment:
As stated

ACNW BRIEFING FOR THE COMMISSION
November 10, 1994

EXAMPLES OF CONSIDERATIONS RESULTING FROM DOE PROGRAM APPROACH

- Use of Bounding Assumptions Will Require a New Appproach by the Staff to Review DOE's License Application. Both the HLW Research and the Technical Assistance Programs Should be Reevaluated to Ensure They Bear Directly on Information Necessary to Qualify DOE Model Assumptions.

- A Reference Design of the Repository System Should be Prepared by DOE at a Significantly Accelerated Schedule Before Initial High Level Decisions on Site Suitability are Completed

- Application of Performance Assessment (PA) Under the Program Approach Assumptions May be Difficult Due to Uncertainties in Both Concept and Data.

- Reduced Data Acquisition Will Result in Greatly Increased Reliance on Expert Judgment. Protocols, Including Guidelines for Resolving Conflicts, Should be Expeditiously Developed.

Volcanism, Tectonics, and Natural Analogs in High-Level Radioactive Waste Disposal Research

- Volcanism, tectonics, and natural analogs selected for review for specific reasons: volcanism was on a fast-track, tectonics provides geologic framework for other processes, and natural analogs selected in response to Commission concerns.

- The general relevance of natural analog studies has not been established because of lack of integration of the results into PA.

- Projects in volcanism and tectonics need to be brought to fruition. Greater emphasis needed on accelerating model development and studies on coupled effects of volcanism and tectonics

- RES should place greater emphasis on the use of PA throughout its planning process to ensure risk-based priorities for its programs.

- Future topics that are in the planning stages include subsurface hydrologic research, and modeling. They are logical follow-ons because of their significant role in PA and ground-water travel time (GWTT).

- ACNW has committed to continue to evaluate RES program priorities and schedules in light of DOE's Program Approach.

- The Program Approach leaves open the role of iterative PA in setting research priorities;

- NRC staff needs to consider what adjustments it must make (if any) to preparation for DOE's planned use of bounding analyses and greater reliance on expert judgement,

o We are pleased that the EDO response indicates staff has received comments very positively.

NMSS Performance Assessment in Waste Management and Disposal

Overall WM PA Comments

- Expert judgment is becoming more significant (e.g., DOE's shift to the Program Approach); guidance is needed soon in both the HLW and LLW areas for licensing decisions.

- NRC staff should expand the use of risk-based modeling in order to be more useful to license decision making.

LLW PA Comments

- The ACNW recognizes the progress made in the LLW PA capability by the NRC staff.

- The Committee is concerned with regard to the consistency with which PAs are performed among the Agreement States and between the states and the NRC.

- Since there are existing LLW disposal sites, the Committee remains concerned about the programmatic decision not to proceed with field validation of the modeling capabilities at such sites. Decommissioning licensing actions will be used as a surrogate; the implementation of this appraoch is not clear to the Committee.

- The Committee encourages the use of probabilistic analyses for LLW disposal site performance.

HLW PA Comments

- The NRC staff and the Center for Nuclear Waste Regulatory Analyses (CNWRA) should be complimented and encouraged in its efforts to establish an independent PA capability in both HLW and LLW disposal areas. The Committee took special notice of the way PA has been integrated into the entire program, both in planning as well as in setting priorities for the technical research.

- The Committee is keyed into the need for computer models to reflect physical world. Some issues include:

  - There may be a role for a simple, first-principles model to determine whether the complexity has not overwhelmed the PA process?

  - Codes and caveats: how do we know that there aren't significant code errors, how do we find them, how do we minimize the potential for such errors?

- The NRC staff must make PA boundary conditions, logic models and parameter values more visible and easy to change.

- Models should accommodate importance ranking of issues for different repository performance periods and indicators.

ACNW Working Group - Use of Groundwater Dating Methods at Yucca Mountain

- **Primary focus was on isotopic evidence for existence of rapid flow paths via fracture and faults that may cause violation of NRC's GWTT requirement in 10 CFR 60..**

- **Results of isotopic groundwater dating will be used by DOE to support demonstration GWTT for site suitability and licensing; interpretation of these results is likely to be difficult.**

- **Results appear to indicate a highly heterogeneous flow system with multiple flow paths, some of which are quite rapid, via fractures or faults.**

- **There is limited usefulness in assuming an average infiltration rate over the entire site surface because the percolation flux at surface is known to vary widely over the site.**

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

TITLE: AFFIRMATION/DISCUSSION AND VOTE
(PUBLIC MEETING)

LOCATION: ROCKVILLE, MARYLAND

DATE: TUESDAY, NOVEMBER 15, 1994

PAGES: 1-4

DISCLAIMER

This is an unofficial transcript of a meeting of the United States Nuclear Regulatory Commission on November 15, 1994 in the Commission's office at One White Flint North, Rockville, Maryland. The meeting was open to public attendance and observation. This transcript has not been reviewed, corrected or edited, and it may contain inaccuracies.

The transcript is intended solely for general information purposes. As provided by 10 CFR 9.103, it is not part of the formal or informal record of decision of the matters discussed. Expressions of opinion in this transcript do not necessarily reflect final determination or beliefs. No pleading or other paper may be filed with the Commission in any proceeding as the result of, or addressed to, any statement or argument contained herein, except as the Commission may authorize.

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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AFFIRMATION/DISCUSSION AND VOTE

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PUBLIC MEETING

Nuclear Regulatory Commission
One White Flint North
Rockville, Maryland

Tuesday, November 15, 1994

The Commission met in open session, pursuant to notice, at 10:30 a.m., Ivan Selin, Chairman, presiding.

COMMISSIONERS PRESENT:

IVAN SELIN, Chairman of the Commission
KENNETH C. ROGERS, Commissioner (via telephone)
E. GAIL de PLANQUE, Commissioner (via telephone)

STAFF SEATED AT THE COMMISSION TABLE:

MARTIN MALSCH, Office of the General Counsel

JOHN C. HOYLE, Acting Secretary

PROCEEDINGS

[10:30 a.m]

CHAIRMAN SELIN: Good morning. Today we have an affirmation session. I would just note in passing that this is the first telephonic affirmation we have had in recent years, and certainly since we put in the arrangement to have such a telephonic affirmation. Commissioner Rogers is attending the NARUC conference in the west and Commissioner de Planque is at the Annual Conference of the ANS and so we are having this affirmation telephonically. Mr. Hoyle would you led us through the affirmation please.

MR. HOYLE: Thank you, Mr. Chairman. The paper for affirmation today is SECY-94-261. The Commission is being asked in this paper to approve the publication in the Federal Register amendments to 10 CFR Parts 30, 32, and 35. This final rule provides for properly qualified nuclear pharmacists and authorized users who are physicians greater discretion to prepare radioactive drugs containing byproduct material for medical use. The rule also allows medical use of radiolabeled biologics and contains other miscellaneous and conforming amendments.

CHAIRMAN SELIN: It's qualified nuclear pharmacists and its authorized users who are physicians, right? I mean the pharmacists don't have to be physicians.

MR. HOYLE: That's correct, sir.

CHAIRMAN SELIN: Thank you.

MR. HOYLE: There are conforming amendments necessary to clarify and update the current regulations. All Commissioners have approved this final rule with the changes circulated last week and some changes we circulated last night. I ask you at this time to affirm your votes.

CHAIRMAN SELIN: Aye

COMMISSIONER ROGERS: Aye

COMMISSIONER de PLANQUE: Aye

MR. HOYLE: Thank you I heard all the votes Mr. Chairman.

CHAIRMAN SELIN: We have no other business.

MR. HOYLE: No sir, not at this point.

CHAIRMAN SELIN: In that case the meeting is adjourned. Thank you very much.

MR. HOYLE: Thank you Commissioners

CHAIRMAN SELIN: Thank you very much Commissioners.

[Whereupon, 10:32 a.m., the above-entitled matter was adjourned.]

CERTIFICATE

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

TITLE OF MEETING: Affirmation/Discussion and Vote

(PUBLIC MEETING)

PLACE OF MEETING: Rockville, Maryland

DATE OF MEETING: Tuesday, November 15, 1994

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: Gloria Thomas

Reporter: (TAPE RECORDING)