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NUCLEAR REGULATORY COMMISSION

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PERIODIC MEETING WITH ADVISORY
COMMITTEE ON NUCLEAR WASTE (ACNW)

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PUBLIC MEETING

Nuclear Regulatory Commission
One White Flint North
Rockville, Maryland

Friday, February 26, 1993

The Commission met in open session, pursuant to notice, at 9:00 a.m., Ivan Selin, Chairman, presiding.

COMMISSIONERS PRESENT:

IVAN SELIN, Chairman of the Commission
KENNETH C. ROGERS, Commissioner
FORREST J. REMICK, Commissioner
JAMES R. CURTISS, Commissioner

STAFF SEATED AT THE COMMISSION TABLE:

SAMUEL J. CHILK, Secretary

WILLIAM C. PARLER, General Counsel

ANDREW BATES, Office of the Secretary

DADE W. MOELLER, Chairman, ACNW

MARTIN J. STEINDLER, ACNW

PAUL W. POMEROY, ACNW

WILLIAM J. HINZE, ACNW

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

2 9:00 a.m.

3 CHAIRMAN SELIN: Good morning, ladies and

4 gentlemen.

5 The Commission is meeting at this time to

6 receive a periodic briefing from our Advisory

7 Committee on Nuclear Waste and we welcome Committee

8 Chairman, Doctor Dade Moeller, and the other members

9 of the ACNW in attendance.

10 We'd like to congratulate you on the

11 milestone that you reached in January when the

12 Committee held its 50th meeting and just yesterday

13 completed its 51st meeting. The Commission takes note

14 of this accomplishment and extends its congratulations

15 to all the Committee members.

16 Safe and effective management and disposal

17 of nuclear waste, both high and low-level, are

18 fundamental in increasing importance to the beneficial

19 use of nuclear materials. In fact, it's probably fair

20 to say that without a perceived solution of the high-

21 level waste problem, then much of the work that we've

22 been doing on license renewal and on Part 52 will not

23 be all that productive in the long run.

24 The Committee plays an important role in

25 advising the Commission on nuclear waste issues and

1 the Commission, as always, has a great deal of
2 interest in what the Committee has to say.
3 You have a very interesting agenda today,
4 Doctor Moeller, and we look forward to what you have
5 to say.
6 But first, I'll ask my colleagues if they
7 have any remarks.
8 COMMISSIONER REMICK: Nothing.
9 CHAIRMAN SELIN: Thank you.
10 DOCTOR MOELLER: Well, thank you, Mr.
11 Chairman. We came at your invitation to discuss the
12 two reports specifically that we submitted during the
13 month of February. One of them on February the 11th
14 was our -- well, we titled it, "Significant Issues in
15 the High-Level Waste Repository Program," and in
16 essence it was another step forward on our systems
17 analysis of the various issues there. Then, Doctor
18 Steindler will be responding or leading us in that
19 discussion. Then, on the second item, the issues
20 related to the Energy Policy Act, Section 801, I'll be
21 handling that. So, we'll call on Marty to move
22 forward.
23 DOCTOR STEINDLER: Thank you.
24 If you recall the background, we had a
25 discussion with the Chairman who expressed an interest

1 in finding out whether or not the high-level waste
2 program had any significant holes, major show
3 stoppers, and suggested that perhaps the thing we
4 ought to do is have a look to see whether or not one
5 could conveniently, or even inconveniently, do a
6 systems analysis, top down systems analysis of the
7 overall program to uncover any such difficulties. We
8 looked at that, reported back to the Commission last
9 year that we didn't see anything major and that
10 systems analyses were being pursued by both the staff
11 to some extent and certainly DOE.
12 Following that, the focus shifted slightly
13 and we were asked to specifically enumerate, if we
14 could, any major issues that we thought should be
15 brought to the attention of the Commission. We have
16 had a number of discussions on that topic. We elected
17 to broaden the discussion beyond purely technical
18 issues and found a number of interface issues. We
19 wrote you a letter, a report in December of last year
20 on the item and the staff has recently responded to
21 some of the points that we raised in that. I want to
22 kind of briefly touch on a number of those issues and
23 certainly not go through them all again that we've
24 already covered once.
25 Let me give you a summary, however, of the

1 conclusions one might draw from that particular
2 exercise.
3 First, we found no major show stopping
4 holes, technically describable, that would lead to
5 what we might call a hemorrhage of the program to be
6 life threatening to it. We did identify some issues
7 that are much less than huge, but if not attended to
8 could become Achilles heels later on when the
9 licensing process draws closer. Those things, which
10 I'll touch on, require resolution to keep the program
11 going and particularly to keep it on schedule.
12 Schedule is an important issue as implied in the
13 notion of having a solution at hand.
14 The things that we're going to talk about
15 may seem like trivial minutia, but they are not
16 necessarily so and they will become less so as time
17 goes on. The fact, I think, remains that the
18 technical aspect of building a repository is not a
19 show stopping issue. And it really within very wide
20 limits doesn't make any difference whether you focus
21 on Yucca Mountain or some other reasonably suitable or
22 equally suitable site. There is a presumption that
23 Yucca Mountain is suitable. I don't know that and
24 we're presuming that, but for the moment Yucca
25 Mountain is the target and it seems to be an

1 interesting target.

2 Let me simply walk through then to at
3 least identify some of these issues that we talked
4 about and then come to focus on those where the staff
5 and we are not quite in agreement and tell you what
6 our view is and what kind of things we're going to
7 follow up on.

8 The first one that we cited, of course, is
9 one that's already being taken care of and that is
10 that we thought it was very important for the
11 Commission and the staff to forward to the National
12 Academy in response to the Energy Policy Act its
13 advice on the kind of things that the National Academy
14 report should contain. That's in process and it
15 remains to be seen what the National Academy Committee
16 will do with that.

17 We indicated that the role of enhancing
18 one barrier in a multi-barrier system to offset either
19 deficiencies to some extent or uncertainties in other
20 barriers in this multi-barrier system ought to be
21 something that the staff should begin to tolerate more
22 so than they're currently tolerating. I'll touch on
23 that a little bit more.

24 We have recently had some additional
25 discussion on the issues of expert judgment and the

1 technology that is likely to be involved in the
2 licensing process is such that expert judgment, we
3 feel, is a mandatory process that will have to be
4 used. The protocols for that are subject to, we
5 think, a horrendous amount of argumentation, since
6 that's not a well developed, long established science,
7 and we urge the consideration of providing through
8 rulemaking some of the bases under this decisions
9 about what is the suitable protocol and what is not,
10 that that be done. I'm going to touch on that a
11 little bit later.
12 In addition, I think the other point that
13 predictive science and technology has to look at is
14 the utilization of models and the qualification of
15 both models and the data that goes into them. It
16 isn't clear to us, and it still is not clear to us,
17 that the methodology for deciding what is a good model
18 and what is not has been given sufficient guidance.
19 I will touch on that also.
20 There were a number of other points, most
21 of which, I think, are of, we think, less importance
22 as time goes on, which we can certainly touch on if
23 you like. But I'd like to then pursue some of these
24 a little more closely.
25 Let me say at the outset that none of

1 those issues that I've touched on represent what I
2 would call explicit scientific issues. They're all
3 interface issues and that's in keeping with the
4 general notion that the science and technology is not
5 an area where there are severe uncertainties of such
6 magnitude at the moment that would represent show
7 stoppers. It's true that investigations in some areas
8 are still exploring ways of doing the job. That is
9 the science folks have not learned how to get the
10 right answer on the first try, but that's not
11 something that we see is going to be permanently
12 debilitating.
13 So, the things that I intend to talk about
14 will be interface issues between what I guess either
15 are institutional licensing issues and the scientific
16 community.
17 Well, let me touch on a couple issues.
18 The staff seems to have taken a fairly rigid position
19 on this role of exchanging capabilities of one of the
20 barriers for the deficiencies or uncertainties in the
21 other. Specifically, the issue arises in the
22 enhancement in the way in which the enhancement of the
23 engineered barrier system could be offset for
24 uncertainties that you would encounter when you're
25 doing geologic studies. It may also be that some of

1 the geology is not exactly what you would like it to
2 be. I think the position that says, "No, you're not
3 really allowed to do that," is not particularly
4 productive. It doesn't seem to us to be in keeping
5 with what the regulations indicate. Equally
6 important, it removes from the Commission the
7 flexibility that was specifically built into the Part
8 60 for making decisions and potential tradeoffs. This
9 is an issue that looks to us as though it may well
10 turn out to be difficult in the licensing process and
11 we probably will need to continue our discussion with
12 the staff on that.
13 CHAIRMAN SELIN: Could I stop you for a
14 second?
15 DOCTOR STEINDLER: Yes.
16 CHAIRMAN SELIN: Is there a possibility of
17 coming up with a couple of examples that would satisfy
18 both the Committee and the staff as opposed to arguing
19 on such general terms about one says, "The
20 probabilities can't just be divided into equal parts
21 a priori," and the other one says, "You're against
22 defense in depth," and these are sort of extreme
23 positions. Is there some way to illustrate the --
24 DOCTOR STEINDLER: I would think we could
25 do that. The specific issue that, for example, has

1 most recently come up is whether or not a significant
2 enhancement in the performance of the engineered
3 barrier system, for example the canister, could be
4 used to offset inadequate geochemistry in the far
5 field.
6 The argument is fairly simple. If, in
7 fact, the Department can provide a robust package and
8 demonstrate its likely robustness over a period that
9 pushes close to the 10,000 year period rather than the
10 substantially complete containment 1,000 year period,
11 then the source term for the far field migration, and
12 hence presumably the release into the far field, could
13 be significantly reduced and the requirements on the
14 quality of that geology or geochemistry can be dropped
15 while still achieving the same general level of
16 protection for the health and safety of the public.
17 CHAIRMAN SELIN: It would be useful if you
18 could follow that up. The kind of thing that occurred
19 to me when I read the two comments was if you're
20 talking about the basic underlying risks, the idea
21 that you have to distribute the uncertainty is pretty
22 powerful. But if you're talking about some of the
23 peripheral criteria which are dominated by the
24 uncertainties rather than anything else, if you're
25 talking what's going to happen in the far field,

1 what's going to happen 10,000 years from now, if one
2 part could be shown to have more confidence than one
3 thought, then one wouldn't have to be quite so
4 conservative in some of the other criteria.
5 Well, the example you brought up appears
6 to be relevant to the thinking I had on that. I would
7 be useful if you could follow up on it.
8 DOCTOR HINZE: Well, that is not to say
9 that you disregard the geology and the geological
10 factors. I want to make it clear that that's not to
11 stance we're taking. You don't build a battleship and
12 drop it down the mouth of a volcano to store it. That
13 kind of thing. But there are legitimate tradeoffs in
14 the uncertainties that are going to remain after the
15 characterization.
16 COMMISSIONER REMICK: Marty, I understand
17 your arguments on balancing and tradeoff and initial
18 inclination is to agree. But laying this on the
19 staff, isn't this something that DOE itself proposed
20 in 10 CFR 960 and which we then concurred in? In
21 other words, didn't DOE put itself in this position by
22 proposing this in their siting guidelines back in the
23 mid-'80s in 960?
24 DOCTOR STEINDLER: I don't know. You may
25 be right.

1 COMMISSIONER REMICK: They did.

2 DOCTOR STEINDLER: Yes.

3 COMMISSIONER REMICK: I can read you one
4 paragraph. It says, "Furthermore, engineered barriers
5 shall not be used to compensate for an inadequate
6 site, mask the innate deficiencies of a site, disguise
7 the strength and weaknesses of a site and the overall
8 system and mask differences between sites when they
9 are compared." We went on to concur with that then in
10 the Federal Register. So, I don't think it's fair, as
11 I understand it, to lay it completely on the staff.
12 I think it has to be something that DOE and the staff
13 have to --

14 DOCTOR STEINDLER: Quite so. I don't mean
15 to identify --

16 COMMISSIONER REMICK: Sure.

17 DOCTOR STEINDLER: -- blame. That's not
18 the issue. I think -- all I guess I'm stating is the
19 notion we had was that there should be some reasonable
20 tradeoff allowed again, as Bill pointed out, not to
21 offset a totally inadequate site. The only reason the
22 staff role comes in, it comes in for two reasons. One
23 because of the response of the EDO and the other one
24 is the communications that they've recently had,
25 relatively recently had with DOE when that issue came

1 up.

2 But our intent, I guess, is to pursue that

3 with the staff. We've had -- in our December 1st

4 letter, we also pointed out the distinction between

5 960 and 60 and their relative roles in this process

6 seemed unclear to us and the staff, I think correctly,

7 pointed out to us that their interest is Part 60.

8 It's that that we try to focus on to the extent we

9 can.

10 COMMISSIONER ROGERS: Just a little bit on

11 that, Marty. It occurs to me that if one gives more

12 credit for the barriers, that that might be done

13 through dealing with not the suitability of the site

14 but the uncertainties in the measures of suitability,

15 rather than -- so that you're not in the business of

16 accepting in a sense a site that's less than

17 desireable, but that the credit that you take for the

18 engineered barriers is to make up for uncertainties in

19 how well you can actually establish that suitability.

20 DOCTOR STEINDLER: Right. I think that's

21 precisely correct and I would guess that is the

22 context in which the 960 description was likely to be

23 written.

24 COMMISSIONER ROGERS: Well, it seems to me

25 if that's the approach, that that's a little more

1 sophisticated concept than the simple one of making a
2 tradeoff of a barrier against a site deficiency. It
3 relates to your knowledge and ability to establish the
4 suitability of the site. But in other words, you
5 might tolerate a little bit broader uncertainty in
6 certain parameters, but not necessarily the mean value
7 would be changed that you'd be willing to accept, if
8 you know what I mean.
9 DOCTOR MOELLER: Reviewing the history of
10 this though, and it may be that we were failing to
11 communicate with the staff or we don't understand what
12 they're saying or vice versa, but Commissioner Curtiss
13 I'm sure recalls a couple years ago when you directed
14 to us the question to review the subsystem
15 requirements of Part 60. The Committee did that. We
16 met with the staff and I need to look up that letter,
17 but as I recall at that time when we discussed it with
18 the staff, we all came to the bottom line that it was
19 the system that must perform and meet the standards
20 and that you could have some flexibility in the
21 subsystem requirements. Am I wrong in that?
22 COMMISSIONER CURTISS: Well, I think, as
23 I recall the discussion at the time, the staff's
24 position as they reflected it in their February 11th
25 response has been consistent throughout, which is to

1 say that Part 60 requires that each of these subsystem
2 performance criteria in 60.113 be viewed as a minimum
3 and independent criterion. I'd have to go back and
4 look at the letter specifically, but I don't recall
5 that their position has evolved on that point.
6 Go ahead, Ken.
7 COMMISSIONER ROGERS: No, no. That's my
8 recollection as well. So, if you really want to take
9 some credit for the engineered barriers, then what you
10 do is you take credit through being willing to stop in
11 a certain sense and accept a little bit more
12 uncertainty in the mean value of one of these
13 essential parameters rather than change the mean value
14 that's acceptable.
15 DOCTOR STEINDLER: Well, that
16 fundamentally has been perhaps our ill-explained
17 focus. Our concern was driven by the notion that if
18 you require far field precision, you may be engaged in
19 the process that is a 50 year exploratory operation,
20 which you simply can't do, whereas you can solve that
21 problem I think a lot easier. Again, schedule, I
22 think in this case, is the driving force.
23 COMMISSIONER ROGERS: Well, it seems to me
24 if you take this approach you can still be consistent
25 with the necessity of satisfying individual

1 requirements, but as best you can but willing to
2 accept, as I say, a little bit more uncertainty.
3 DOCTOR STEINDLER: We would certainly
4 agree with that.
5 DOCTOR HINZE: In our letter we used the
6 term "potential difficulties," and that was really
7 said in the context of uncertainties.
8 COMMISSIONER ROGERS: Yes.
9 DOCTOR HINZE: We didn't perhaps say it as
10 precisely as we should have.
11 DOCTOR STEINDLER: Okay. Well, let me
12 move on to one --
13 COMMISSIONER CURTISS: Marty, could I
14 just --
15 DOCTOR STEINDLER: I'm sorry, yes.
16 COMMISSIONER CURTISS: Excuse me. If I
17 could just carry it a step further. This is an issue
18 that, as the Chairman indicated, I've been interested
19 in pursuing. I guess the challenge that I see, and
20 I'm not sure how to come to grips with it, is this.
21 Whether you view it on sort of a rough level of
22 trading off the performance that would be achieved
23 with respect to each of the subsystem performance
24 criteria, the release rate, the package and the
25 groundwater travel time, or in what I think is a more

1 sophisticated way to look at it, the trading off of
2 uncertainty and the way you calculate that, take
3 advantage that you're probably going to be much more
4 highly certain of the performance of maybe the
5 container than you would perhaps on groundwater travel
6 time.
7 Either of those two approaches, and this
8 is the challenge that I haven't been able to come to
9 grips with, but either of those two approaches, it
10 seems to me, presupposes that the subsystem
11 performance criteria in the aggregate are designed to
12 achieve what I think you've referred to here as an
13 overall level of protection. That is to say if you
14 add up the release rate and the package requirements
15 and the groundwater travel time, the sum of those
16 three will give you a level of performance, defense in
17 depth, that accumulates to that level of performance
18 that is X. In reviewing the history of this issue and
19 in looking at the way those requirements were
20 formulated in 113, I'm not sure that's the case. I'm
21 not sure it was ever determined back in the late '70s
22 and early '80s that what we've done in Part 60 was to
23 define a level of overall performance that we would
24 expect the repository to meet and then in a relatively
25 disciplined way laid out the three subsystem

1 performance criteria, the sum of which would yield
2 that level of performance.
3 So, as you look at this question over
4 time, it seems to me it's important, if that's in fact
5 the case, and I think it is, to recognize that as you
6 say, "Let's trade off performance on one or the other
7 or maybe on the trading off of uncertainties," that
8 that approach almost presupposes that you've defined
9 an overall level of protection that you can then, as
10 you trade off these things, recalculate and see if
11 you've achieved that. I'm not sure how to do that.
12 If your deliberations on this issue lead you to a
13 solution to that question, enlighten me.
14 Secondly, getting down related to that but
15 also related then to the trading off of one or two of
16 these issues, it seems to me what you need is an
17 algorithm in order to permit you to accomplish that.
18 Commission Rogers' notion strikes me as a very
19 attractive one and it's a much more sophisticated
20 approach than simply saying, "We'll take a notch down
21 here and crank it up a notch here." But again, here,
22 I'm not sure what the algorithm is for making that
23 kind of tradeoff in the context of dealing with
24 uncertainties. At some point, of course, all of this
25 will come before a board and when you say, "We're a

1 little bit more confident here, perhaps a little bit
2 less confident there," sometime between now and then,
3 if that's an approach that the current regulations
4 permit or that makes sense, it seems to me there'd be
5 some merit in defining in more detail how you make
6 that rather than just a subjective sense that we have
7 a little bit more performance here, a little bit less
8 here and it all sums up to the same thing.
9 So, you don't need to address those here,
10 but as your deliberations go on, I think those are on
11 the key issues that I see in this arena.
12 DOCTOR STEINDLER: Well, if we can digress
13 into that issue for just a second, the assumption has
14 been all along, but it may not have been explicit when
15 the original regulations were written, for obvious
16 geometric reasons, that the EPA criteria will be the
17 final determiner of having met the requirements.
18 That's still the case. So, you know what the sum is,
19 you simply don't know what the components are.
20 COMMISSIONER CURTISS: Well, just to be
21 precise here, we also know that if you meet the
22 subsystem performance criteria, you may or may not --
23 it doesn't follow that you meet the EPA standards and
24 vice versa. So, I'm not sure I agree that we've
25 established that clear a link between the two and that

1 you can therefore use the EPA goal, whatever it might
2 be, as the mechanism for defining how you approach the
3 issue of 113 subsystem performance criteria.
4 DOCTOR STEINDLER: There are some
5 subsystem -- there is at least one subsystem
6 performance criteria, namely the release rate, that
7 has run into problems, arithmetic problems in a sense
8 with the former table in the EPA rules. That fairly
9 minor glitch, although two orders of magnitude may not
10 be viewed as a minor glitch by some people, but that
11 arithmetic discrepancy is the only one that I can see
12 offhand where you clearly have an existing conflict.
13 The sum of the subsystems criteria, coupled with the
14 site qualification process, is alleged to provide a
15 repository framework that can meet the EPA criteria.
16 The issue really is to what extent do you want to hold
17 stringent requirements to the subsystems criteria, at
18 the same time holding to the EPA criteria?
19 I think the point that you make is the
20 only good one that needs to be answered in this case.
21 We will know some things a lot better than others and
22 it's that offset of uncertainties which sum to the
23 adherence to the EPA criteria which should determine
24 the performance of repository.
25 I think the problem basically comes down

1 to how much attention do we want to give to the rigid
2 interpretation of how the various nested systems
3 function. Looking at it from our standpoint, and of
4 course we don't have the job you do, but looking at it
5 from our standpoint, one can simply recognize that
6 there needs to be flexibility in the system while
7 keeping rigidly to the bottom line. I think that
8 would be the mode that we would go to. But yes, we
9 can probably find other ways of addressing the issue
10 of uncertainties in specific technical terms and
11 provide some examples.
12 We would like to continue to discuss with
13 the staff their views on this and perhaps we can
14 sharpen our respective views upon this issue and come
15 back later.
16 Well, let me move on to at least one other
17 area, perhaps a few more. I mentioned the role of
18 expert judgment and we've recently had some
19 discussions in our meetings on the whole question.
20 Expert judgment continues to be a fairly new and
21 somewhat unrefined technology, if you want to call it
22 that. The various protocols that people use to make
23 decisions on how to implement expert judgment are
24 subject to a lot of argument. There's no doubt that
25 the role of expert judgment will be important in this

1 whole process of defining whether or not a particular
2 site is suitable and whether or not the performance of
3 a repository can be estimated into the future well
4 enough.
5 Superimposed on that is the most recent,
6 we think somewhat interesting issue of the Supreme
7 Court beginning to address the question of what is
8 good science and how do you know or who do you trust
9 to tell you that. All of those issues are
10 sufficiently flexible, so our contention is that it
11 needs to be addressed in some sort of a firm fashion
12 in order to avoid a great deal of difficulty later on
13 at the licensing process. Again, this is an issue
14 that has an institutional interface, but really deals
15 with how do you address the problems of handling
16 models and so on and so forth.
17 Paul Pomeroy has been our resident expert
18 on expert judgment and he may have a few words to say
19 on the issues that we've raised here.
20 DOCTOR POMEROY: Fine. I would like to
21 say that there are at least two things going on right
22 now that may help us to reach some closure with the
23 staff on the question of how much guidance in the use
24 of expert judgment is appropriate. The first one is
25 the Supreme Court case that Marty has mentioned. It's

1 tentatively expected. I gather that there might be a
2 decision by the Supreme Court in the fall with regard
3 to some of the issues that are brought forward there.
4 These are particularly in regard to the Rule 702 and
5 703 and the Frye Doctrine. The Supreme Court may
6 provide us some guidance in the appropriate way to
7 utilize expert judgment in the decision making
8 process.
9 It's my feeling, of course, that the
10 existing evidentiary rules are excellent in the sense
11 that they do allow us to eliminate a lot of junk
12 science in the hearing processes. At the same time,
13 they do give rise to some concerns that they could be
14 used to eliminate much of the expert judgment that is
15 brought forward by all of the parties in the process.
16 So, we're looking forward to their decision on that
17 matter.
18 The second thing is, of course, as you
19 probably are aware, the staff is pursuing Phase 2.5 of
20 its iterative performance assessment. Phase 2.5
21 involves the actual selection of one area within the
22 repository process where expert judgment will be
23 extensively used and after that selection carrying out
24 the entire elicitation process of expert judgment and
25 carrying that through as far as possible to a bottom

1 line conclusion that the staff might reach. We feel
2 that that's going to be a very educational process and
3 we're following the planning and execution of that
4 phase with rather keen interest. Following its
5 completion, we're going to explore with the staff
6 again the question of what their feelings are
7 regarding the appropriateness of issuing guidance,
8 whether that guidance is in the form of a staff
9 technical position initially followed by rulemaking or
10 some rulemaking activity.
11 I think I just want to say also that these
12 concerns as evidenced by a three day meeting sponsored
13 by DOE in Albuquerque last November and conversations
14 with individual members of most of the interested
15 parties involved, those conversations all indicate
16 that there is a concern for this guidance, the
17 existence of this guidance and a concern regarding the
18 legal aspects of the admissibility of some of the
19 expert judgment that may come forward. We're working
20 with those groups also to try to coordinate our
21 efforts and not duplicate efforts within the entire
22 program.
23 So, I think we will revisit the issue with
24 the staff following the Supreme Court decision and the
25 completion of Phase 2.5.

1 DOCTOR STEINDLER: Okay. Let me touch on
2 one or two other subjects. The whole question of how
3 do you qualify data that has not been -- that you pull
4 out of the literature that's been done some time ago
5 continues to be one that we're not very comfortable
6 with. The staff has issued a set of guidance. DOE
7 has done the same thing. On how you do that, let me
8 simply say we plan to test the system, so to speak, by
9 looking at selected documents in the literature to see
10 whether or not they would or would not with those
11 guidelines qualify. One of the ones that I personally
12 would like to pick on is Pons and Fleshman's paper on
13 cold fusion, to see whether or not it would qualify as
14 an acceptable piece of science under the guidelines
15 that are currently being used. We haven't done that,
16 but perhaps with some dialogue with the staff and
17 ourselves, we may be able to test that system as a way
18 to determine whether or not those models or that
19 protocol is functional.
20 There is a presumption, to be sure, which
21 we have to be a little careful of and that is the
22 presumption is that that paper probably is not good
23 science. We'll see what comes out of it and whether
24 the system works.
25 COMMISSIONER REMICK: Marty, why would you

1 use that particular paper rather than a specific
2 reference that might be at issue in the high-level
3 waste program? There certainly have to be examples
4 there.
5 COMMISSIONER ROGERS: Just because it
6 isn't?
7 DOCTOR STEINDLER: That's the point.
8 COMMISSIONER REMICK: No. I think it
9 would be very valuable to know a specific example in
10 the high-level waste area.
11 DOCTOR STEINDLER: There's nothing that
12 prevents us from also doing that. If, in fact,
13 there's general agreement, which at the moment I think
14 is probably to be found, that that particular paper is
15 not particularly acceptable. It's not a particularly
16 good science and would not serve -- if it dealt with
17 the subject that's pertinent to the repository, it
18 would not serve the repository well. What we would be
19 looking for is to make sure that the protocol that's
20 going to be used would, in fact, reject that paper.
21 That's what we're looking for. But clearly that's one
22 sided.
23 COMMISSIONER REMICK: I think you're
24 getting into a very delicate area.
25 COMMISSIONER ROGERS: Yes.

1 DOCTOR STEINDLER: Well, on the other
2 hand, that system hasn't been tested and that's been
3 a concern of ours because models are going to have to
4 use that. What you don't want to do is get to the
5 licensing process and then argue about how to qualify
6 the information that goes into the models.
7 COMMISSIONER ROGERS: Well, if I could
8 just ask a question here, it seems to me that you're
9 talking about two different things. One is bad
10 science and the other is out of date science. Out of
11 date science was good science at one time. There are
12 a lot of things we know today that at the time they
13 were done were the best there was and perfectly
14 acceptable within the state of scientific knowledge
15 and classical physics versus relativistic physics, for
16 example, or quantum physics. And we know that some of
17 the elements of what were incomplete early science
18 have still a certain degree of validity, but are
19 incomplete. So, that's a different issue from what is
20 good science versus bad science. What it seems to me
21 that's a more relevant concern here is early data that
22 may have been incomplete or early experiments that
23 were done that represent the only thing that exists in
24 the literature that really are not quite good enough
25 for today's needs, but at the time they were done were

1 perfectly acceptable, ground breaking perhaps and
2 represented the end of the work that was done. There
3 wasn't anything done after that. But today we may
4 feel that we need a better job on some data
5 acquisition or something.
6 So, it seems to me that's a different
7 question from good versus bad science. It's
8 incomplete studies that may be perfectly -- I wouldn't
9 want to call them bad science, just the best there was
10 at the time, but today the instrumentation and other
11 things might allow for much better studies and much
12 better acquisition of data than was done say 20 years
13 ago or something of that sort.
14 So, I would think that that would be more
15 the serious problem than the introduction of bad
16 science into the arguments.
17 DOCTOR STEINDLER: Well, let me make a
18 couple of comments. One, I don't have any quarrel
19 with the general notion that early work may be
20 incomplete or certainly doesn't carry a subject far
21 enough for our current needs, and that early work,
22 nonetheless, can be perfectly good. But that tends
23 not to be the problem. Let me draw on some personal
24 experience.
25 One of the difficulties we had in the area

1 of materials and the engineered barrier system is
2 examining data that may be, at most, ten years old,
3 which is not very long ago, and recognizing the use to
4 which that data is going to be put. The difficulty in
5 assessing whether or not, for example, a particular
6 leach rate or corrosion rate or a model of a surface
7 reaction is applicable to a particular model that
8 somebody is using for prediction requires -- in order
9 to be able to do that, you have to have a pretty hard
10 look to see how it was done and how well it was done,
11 and whether or not that extrapolation is, in fact, a
12 valid exercise of both the experimental method and the
13 results that are published in some journal done long
14 before QA was involved.
15 By the way, we draw a sharp distinction
16 between quality assurance and the assurance of
17 quality, which is not often done. It's in that
18 context that you want to try and make sure that the
19 system that's been established is, in fact,
20 functional, so that you don't get into interminable
21 arguments about whether John's data published in an
22 electrochemical journal is, in fact, applicable to the
23 model that you're trying to use for extrapolation.
24 That's probably the major issue. That involves --
25 COMMISSIONER ROGERS: I missed a point.

1 DOCTOR STEINDLER: Well, I think that
2 involves the question of good science versus bad
3 science.
4 Now, insufficiency will become obvious.
5 If you don't have acceptable kinetic data, for
6 example, because that's not what the individual was
7 looking at at the time, I think then the issue is
8 fairly clear. You can't use it or you won't use it.
9 Whether or not you have some mechanism of qualifying
10 it is somewhat immaterial.
11 Maybe you and I need to --
12 COMMISSIONER ROGERS: No, I think I
13 understand what you're -- I think there are several
14 different issues here that are all involved in this.
15 DOCTOR STEINDLER: Right. Right. There
16 may well be. The concern again -- I mean our focus
17 tends to be somewhat long-range in the sense that we
18 look at the licensing process and what we really want
19 to do is avoid arguments at that time because
20 resolution of arguments on the protocols of how you do
21 the selection, if you have to go back and do that, now
22 represents a significant delay. If there's a
23 challenge to how that was done, then you basically
24 have to start over again. That's the point.
25 COMMISSIONER REMICK: Marty, I have strong

1 reservations about us getting into a subject of good
2 or bad science in an area where we don't have
3 jurisdiction. I certainly would much prefer you to
4 take some specific examples where we might rely on
5 some information in high-level waste if you're going
6 to do such a test and put the test there. We've at
7 least accomplished something we can directly use then.
8 If you decided that particular example is worthwhile,
9 then we know something or if it isn't. But I
10 personally have reservations about getting into a
11 question of good or bad science in an area in which we
12 just are not involved.
13 DOCTOR STEINDLER: Well, I hear you and we
14 could certainly do that.
15 COMMISSIONER REMICK: That's personal
16 opinion.
17 DOCTOR STEINDLER: No, no, I understand
18 that. I think that's certainly worthwhile. We would
19 try and find suitable accumulations of data in the
20 literature that were done before the advent of a more
21 rigorous control to see whether or not we can make
22 some judgment about it. What we would then have to do
23 is engage people in discussion as to whether or not
24 others view that data to be suitable. That would be
25 the point that we, I think, might have already had

1 accomplished for us if we picked on something like the
2 cold fusion program. But I hear you and we can
3 certainly do that.
4 Well, the final point that I would make
5 for you, without going through the letter from
6 December 1st, is the lack of progress on the licensing
7 support system. It's difficult to determine where the
8 difficulties are. It's an issue which both the staff
9 and DOE have been attacking in one fashion or another.
10 Here also the role of qualifying data to be inserted
11 into that system remains somewhat uncertain. The
12 administrator apparently is not the person to make
13 decisions as to what goes into that system. He is a
14 keeper of a complex information recovery system.
15 Nevertheless, we can envision challenges to what has
16 gone into that system based on applicability based on
17 the ground rules that have been used by the
18 Commission.
19 We're a little concerned that the progress
20 on that is slow. It is not, as are most of these
21 issues, life threatening, but they do have to be
22 resolved in some reasonably short period of time in
23 order to not become as severe an offense.
24 Well, we could probably walk through the
25 rest of our concerns, some of which are relatively

1 minor in the context of major show stoppers, but I
2 think our conclusions are simply this. We don't see
3 any major difficulties in the technical area. We see
4 some interface problems between the procedure that's
5 required for licensing and the technology. We intend
6 to, to the extent that we find it either desireable or
7 convenient to discuss this with the staff to pursue
8 some of these issues, taking into account what we've
9 heard here.
10 One other set of comments. The last time
11 we talked to you the issue was raised as to whether or
12 not the DOE system study was going to be available to
13 us to do the things that we said that should be done
14 but somebody else was already doing. Progress on
15 that, apparently, has become difficult and the
16 originally designed October schedule has now slipped.
17 As far as I know, the document is not done. The
18 technical review board has recently had a discussion
19 with DOE on that score and has not found the thing to
20 be complete and had some comments on it. We continue
21 to watch to see what comes out of this and we'll let
22 you know as soon as we get some insight on that.
23 That, I think, is probably all I should
24 comment on at this point. We've skipped over a number
25 of things, but I'd be certainly happy to try and

1 address questions that may be of interest to you.

2 CHAIRMAN SELIN: Why don't we go on to the

3 second half and then if we have a little time --

4 DOCTOR STEINDLER: All right.

5 COMMISSIONER REMICK: Excuse me. Do you

6 want to hold off the questions on this --

7 CHAIRMAN SELIN: Oh, no, no. If you have

8 an immediate question, that's fine. Go right ahead.

9 COMMISSIONER REMICK: Okay. I could wait

10 or --

11 CHAIRMAN SELIN: No, no. Go right ahead.

12 COMMISSIONER REMICK: Okay. There are a

13 couple things in the letter, Marty, I wasn't quite

14 clear. You raise the question about the properties

15 and suitability of the waste form and perhaps the

16 staff should undertake to define this. I'm thinking

17 of the glass, borosilicate glass and the spent fuel

18 rods themselves. Do you think this is ripe for

19 rulemaking to try to get that issue out?

20 DOCTOR STEINDLER: Well, I must say I read

21 the staff's response and their response has a

22 significant amount of merit in the sense that their

23 argument, as I interpret it, is within very wide

24 limits that's not our focus. Our focus from the

25 regulatory standpoint comes at the edge of the

1 engineered barrier system. How the rest of that
2 package looks and what's being done inside within very
3 wide limits is not a place where we should be making
4 specific guidelines, setting out specific guidelines
5 or regulations. That's certainly a functional view.
6 It's not the one that we had. Our view was that it
7 would be useful if specific guidelines on how you
8 design criteria for a suitable waste form, which after
9 all determined to a large extent what your source term
10 looks like, that that should be done.
11 I don't think the staff is so far off that
12 we would jump up and down and say, "Gee, guys, you
13 really ought to rethink this issue." We have
14 therefore not given any additional thought, but that
15 was the logic that we used.
16 COMMISSIONER REMICK: Okay. Another
17 question --
18 DOCTOR STEINDLER: There is -- I'm sure
19 you're aware of the fact that there is a significant
20 difference in the properties of glass versus spent
21 fuel. Spent fuel has attributes that make it much
22 less stable to potential attack for groundwater than
23 glass. This is why glass was elected and that
24 particular composition chosen.
25 COMMISSIONER REMICK: That's assuming the

1 spent fuel is intact.

2 DOCTOR STEINDLER: Yes.

3 COMMISSIONER REMICK: I thought you were

4 addressing that question too after long-term storage

5 and so forth.

6 DOCTOR STEINDLER: The long-term storage

7 issue, yes.

8 COMMISSIONER REMICK: Okay. Another thing

9 that was not quite clear to me in addressing the MRS,

10 you said the required life of the MRS needs to be

11 defined but you didn't say by whom. I wasn't quite

12 sure if that was an NRC or a DOE type of thing. I'm

13 thinking of DOE in light of the overall plan of MRS

14 and repository. You didn't say who should define it.

15 DOCTOR STEINDLER: Yes. That was

16 deliberate.

17 COMMISSIONER REMICK: Okay. I see.

18 DOCTOR STEINDLER: Now that you raised the

19 question again. It wasn't very clear to us who should

20 do this. Our view, I guess, is that this is really an

21 NRC function. But that gets you into the role and the

22 scope of activities in setting boundaries like that of

23 the Commission. We elected to leave it blank because

24 that's not really something we're very smart on.

25 COMMISSIONER REMICK: The other thing, you

1 indicate in that same thing the Commission should
2 request the NRC staff to develop the details of
3 regulations related to the licensing on MRS. But I
4 thought Part 72 was --
5 DOCTOR STEINDLER: Yes. The staff
6 correctly pointed out to us that as far as they're
7 concerned Part 72 covers all that needs to be covered.
8 We have no reason to doubt that.
9 COMMISSIONER REMICK: You also had the
10 statement in there, "There has been little planning
11 for this eventuality," and that means suppose that a
12 site for an MRS is not found. I assume that's moot in
13 light of the DOE recent indications that they may
14 begin to look at federal sites?
15 DOCTOR STEINDLER: Correct. Circumstances
16 overtook us on that one.
17 COMMISSIONER REMICK: Okay. All right.
18 DOCTOR STEINDLER: We hope that that issue
19 can get resolved because that is the only game in town
20 for backup planning. That's right.
21 COMMISSIONER REMICK: Thank you.
22 CHAIRMAN SELIN: Doctor Moeller?
23 DOCTOR MOELLER: Okay. The second item,
24 of course, was the letter on issues raised in the
25 Energy Policy Act. I thought I would just highlight

1 a few of our statements in there and amplify on them,
2 give you a little bit of the background and thinking
3 that went into them. One of our first statements was
4 that although they would be developing standards for
5 specifically directed to Yucca Mountain, they did word
6 it as generally applicable standards. We said that
7 those were much preferred to site specific standards.
8 And so now, why did we say that? Well, one of the
9 reasons was that we felt that standards that were
10 tailor made for a specific site might lose -- the
11 people who prepared them might lose sight of some of
12 the fundamental principles and concepts and so forth
13 that would underlie them. Also, if you're writing
14 standards for a specific site, the standards may very
15 well imply that you have more knowledge of that site,
16 that you know a lot more about it than later you find
17 out that you do.
18 We noted that the Board on Radioactive
19 Waste Management of the National Academy in their
20 report a year or so ago on rethinking the high-level
21 waste program called for flexibility in standards and,
22 of course, if you have site-specific standards, you
23 run the risk of losing that flexibility. And then
24 lastly, we were somewhat fearful that standards
25 developed for a specific site might lose some of the

1 objectivity or another way of saying even handedness
2 of the work that goes into them. So, those were our
3 thoughts there.
4 The second thought, and if you don't mind
5 maybe I'll zip through and then come back for
6 questions. The second thought was we suggested that
7 there be different standards for different time
8 periods. The reason we were thinking in terms of that
9 was, of course, the farther out you go, the longer you
10 go into the future, the greater is the uncertainty.
11 We also viewed that standards applying during the time
12 in which institutional control is being exercised,
13 those standards might be somewhat different than those
14 post that period when institutional control is
15 available because specifically so long as
16 institutional control is being exercised, of course
17 human intrusion hopefully would be prevented. But
18 furthermore, remedial action could be taken and people
19 would be watching over the site and be prepared to
20 take such action.
21 Then we also said next that we endorsed
22 the health-based, which we interpreted as a risk-based
23 standard. Now, we have a variety of reasons for
24 making that recommendation and these included the fact
25 that health or risk-based standard would permit the

1 public or other scientific groups to compare the
2 stringency or the care of the protection of the public
3 at Yucca Mountain or wherever the repository is with
4 standards for other everyday risk, an item, of course,
5 that Commissioner Remick has been very interested in.
6 Further, a risk-based standard does permit
7 you to set a limit on the risk. Then if the
8 quantification of the health effects that result from
9 a certain dose, if those change in the future and we
10 can anticipate they will because they've changed in
11 the past, you at least don't have to keep changing
12 your risk limit. The risk limit is a fixed number.
13 At least you don't have to change it for that
14 particular reason. You might have to change it for
15 other reasons. But that puts some continuity to the
16 risk-based limit and allows it to be firm.
17 We did say that -- I forget our exact
18 wording, but we did say that a -- interestingly we
19 said, "This approach, if adopted, would place an
20 annual versus a cumulative limit on permissible doses
21 to members of the public. That is, I would say in
22 hindsight, probably not as much of an absolute truth
23 as one might say. I mean if you had an annual risk
24 limit, you could certainly multiply it by 70 years or
25 whatever the lifetime of an individual is and you

1 could come up with a lifetime risk.

2 I think the main point we would make to

3 you is that when we were talking about a cumulative

4 limit, we're talking about a lifetime limit for

5 individuals, not about a 10,000 year risk limit.

6 Also, I thought, and the Committee

7 discussed it briefly, subsequently to preparing our

8 letter, we thought of the fact that maybe there would

9 be some benefit in a lifetime limit versus an annual

10 limit. Certainly that, I'm sure, is something that

11 the staff and the academy will want to think through.

12 A lifetime limit would allow the doses, the annual

13 doses to vary up and down as long as the lifetime

14 limit didn't vary. So, I thought immediately, "Well,

15 that might be a benefit." But the Committee on

16 discussing it pointed out that a repository is not

17 necessarily going to release pulses or major

18 differences day to day or year to year in the amount

19 coming out. It will be more of a steady state or a

20 slow release. So, a cumulative release or risk limit

21 would not have that benefit. Furthermore, a

22 cumulative risk limit would introduce its own problems

23 in record keeping. You'd have to find out what annual

24 risk each person was suffering for every year of their

25 life and total it up at the end and so forth. It

1 would be very difficult.

2 The next item, and I'll digress for a
3 moment, but I believe one of the places that the staff
4 has consistently thought in terms of one thing and we
5 have thought in terms of several others is in terms of
6 the radionuclide release limit versus an individual
7 risk or cumulative risk limit for the public. The
8 staff has said consistently that a radionuclide
9 release has limit, has an advantage of being more
10 easily interpreted and enforced. Well, when we were
11 looking at the individual risk limit, we were viewing
12 it also in terms of its ease of enforcement. The
13 difference, I believe, is that the Committee was
14 looking at the standard in terms not only as a design
15 guide for the repository, but were looking toward its
16 application after closure of the repository.

17 Let me show you what I mean. A
18 radionuclide release limit of course could be used to
19 design the repository. But so could a limit on
20 individual risk to members of the public. After
21 you've closed the repository, a radionuclide release
22 limit which requires you to know releases in a 4 pi
23 geometry, you know releases from the repository in 4
24 pi geometry and in gaseous forms and liquid form.
25 That release limit would be very difficult to monitor

1 post-closure and say, "Yes, this repository is
2 continuing to meet the standards," or, "No, it's not."
3 We have, I guess, in the backs of our minds, always
4 held the thought that at some time in the future, 100,
5 200, 300, 500 years, someone is going to say, "How's
6 the repository doing?" It would be nice to say, "Oh,
7 it's continuing to comply fully with the standards."
8 If you had an individual risk limit, you
9 could say that because you could go out and take
10 samples of drinking water or the air that the people
11 are breathing or the potatoes they're eating. And you
12 could say, "Yes, indeed, they're still complying."
13 It's possible, but it would be extremely difficult to
14 respond to an inquiry in terms of radionuclide release
15 limits and say, "Yes, indeed, this repository
16 continues to meet the standards," particularly because
17 we are postulating that there will be no post-closure
18 geologic types of monitoring systems. We're not going
19 to have underground detectors at the accessible
20 environment to see how many radionuclides have reached
21 that point.
22 So, we like the risk-based standard. We
23 also thought that a risk-based standard helps
24 significantly in overcoming the concern that people
25 have said, "Oh, we have a site with very little water.

1 We'd better go to one with lots of water so the
2 radionuclide leakage or releases will be highly
3 diluted and the individual doses will be small."
4 Well, the risk-based limit overcomes that in many
5 ways, an individual risk limit, because maybe if
6 there's little water there, perhaps there is a
7 probability that any radionuclides that are released
8 will be dissolved in a small volume of water and if
9 someone drinks that water, they will receive a high
10 dose. But the probability of a particular individual
11 out there in the public being that single one, two,
12 ten who drink this small amount of water and receive
13 that high dose, that probability is very low, so the
14 risk is comparably low.
15 Furthermore, the small volume of water
16 assures us that the collective dose, that the number
17 of people who are able to obtain and drink that water
18 is going to be limited. So, it tends to take care of
19 itself. We like it and we therefore pursued or
20 endorsed it.
21 We took up the issues. I believe I've
22 already in a sense covered issue 1. Issue 2 in terms
23 of long-term post-closure oversight, we simply
24 concluded that you cannot anticipate that there will
25 be oversight of the repository thousands of years into

1 the future. Why not just assume there will not be
2 such oversight. Above all, even if you assume there
3 is post-closure oversight, we emphasize that should
4 not be used as a justification to lessen or reduce the
5 stringency of the design of the facility.
6 Furthermore, even if you assume as part of this post-
7 closure oversight that equipment and techniques for
8 mitigating any releases will readily be available, do
9 not let that be used as a justification for reducing
10 the conservatism of the design.
11 However, the Committee continues to
12 promote post-closure monitoring for the simple reason
13 that we believe it's an opportunity to collect data
14 and to learn some lessons from this initial repository
15 and that those lessons then could be applied on
16 similar facilities in the future.
17 The next item was human intrusion. We
18 tended to concur with the Board on Radwaste Management
19 which says it's best to assume it will occur. So, we
20 said, "Assume a probability of one," or we suggested
21 that for human intrusion. As I read it, I'm not a
22 statistician. I thought maybe it should have said
23 probability of 14 or something. We say one meaning
24 that someone sometime, maybe many people many times,
25 will intrude.

1 We also called for or re --

2 COMMISSIONER REMICK: Excuse me, Dade.

3 DOCTOR MOELLER: Yes.

4 COMMISSIONER REMICK: By intrude you mean

5 breach?

6 DOCTOR MOELLER: Yes, we mean really

7 breach. Yes, we did offer several suggestions that

8 someone who just comes close to the repository, you

9 should treat them differently than the people who

10 really drill all the way down and the right into the

11 high-level waste. We do believe that if someone has

12 the technology to do that, surely they'll have the

13 technology to look at what they're bringing up and

14 hopefully monitor it and take appropriate precautions.

15 We also reemphasized one of our earlier

16 recommendations at human intrusion in terms of risk

17 assessment be separated out from the normal procedure

18 similarly to the way or handled in a manner similar to

19 sabotage, how that is handled in the nuclear power

20 plant arena.

21 Then lastly, we put in a statement or a

22 recommendation that scientifically -- that effort

23 should be done to make scientifically supportable

24 predictions and the probability of breaching the

25 various barriers in the repository due to various

1 natural events that could occur over the next 10,000
2 years.
3 As a last comment, I would mention that in
4 our letter we said we had not had an opportunity to
5 read SECY-93-013, which was the staff's comment and
6 background information on this same subject. Since
7 that time, we have had an opportunity to read it
8 individually. I would not say that we as a Committee
9 have discussed it sufficiently to make a lot of
10 comments, but I think in general we'd say that the
11 staff has done a good job of showing the pros and
12 cons, the advantages and disadvantages of each of the
13 various positions that could be taken on the issues.
14 The only places we would have questions would be --
15 well, one that I've already cited and one that I've
16 not. The one that we would take issue with or we
17 would encourage them to be more specific in how they
18 say it. That's when they say that a radionuclide
19 release limit is the easiest type of a standard to
20 enforce or to apply. Maybe apply is a better word.
21 I think they should always say in terms of the design
22 of a repository. We do not agree with it if they're
23 looking out in the future in terms of monitoring the
24 performance of a repository.
25 The second area where we have had a

1 professional interchange, and I'm pleased to comment
2 on this one, that's the concept of the critical group
3 versus the maximally exposed individual. We see
4 definite signs that the staff is coming around to our
5 way of thinking in their tentative preliminary
6 response in terms of EPA's proposed standards for the
7 WIPP facility. They're coming around to that way of
8 thinking and we think it's the way to go and we've
9 learned from then. It appears they've learned
10 something from us.
11 We will certainly be pleased to take
12 questions.
13 CHAIRMAN SELIN: Commissioner Rogers?
14 COMMISSIONER ROGERS: Well, just on this,
15 I did want to come back to Doctor Steindler's
16 presentation for a moment also. How in your risk-
17 based approach do you think about a very low
18 probability event that might result in a significant
19 dose to a large number of individuals? I mean, you
20 know, the small probability, high consequence
21 situation. What is your thinking there on your risk-
22 based standard?
23 DOCTOR MOELLER: Our thinking is that the
24 risk-based approach accommodates that. Maybe
25 accommodate is not the right word, but it encompasses

1 it and it takes care of it. Sure, you'll have a dose
2 limit as well as a risk limit. The dose limit may
3 very well be exceeded, but if the probability of
4 exceeding that dose limit is very small, then it's
5 acceptable probably, perhaps. But you could calculate
6 and see if it's acceptable within the risk envelope.
7 We believe, therefore, a risk-based approach permits
8 you to account and to accept those rare occasions of
9 high dose that may occur to single individuals.
10 DOCTOR STEINDLER: Is your reference to
11 microrem to mega people, in effect?
12 COMMISSIONER ROGERS: Yes, that large --
13 yes. Well, or putting it that way, yes. Yes. There
14 the probability might be reasonable though --
15 DOCTOR MOELLER: Oh, yes.
16 COMMISSIONER ROGERS: -- for microrem.
17 No, I'm really thinking of more the low probability
18 but high consequence rather than reasonable
19 probability of small exposures to large groups of
20 people. I think that one is dealt with a little more
21 easily.
22 DOCTOR MOELLER: And the staff has been
23 concerned, and rightfully so, that if you had a Yucca
24 Mountain with a small amount of water, they've
25 estimated that a person could receive rems under

1 certain situations. But the probability of a given
2 individual being that one person is extremely remote.
3 Therefore, it would be acceptable under our risk-based
4 approach and would not rule out what is a site that is
5 preferable to one with lots of water.
6 COMMISSIONER ROGERS: But then aren't you
7 really talking about the probability rather than what
8 we normally call risk? Namely the product to the
9 consequences and the probability?
10 DOCTOR MOELLER: Yes. Yes.
11 COMMISSIONER ROGERS: You really are
12 talking about the probability. It's the low
13 probability that makes it acceptable rather than the
14 low risk?
15 DOCTOR MOELLER: Well, if we calculate the
16 consequence, the product of the consequences times the
17 low probability, the product is low enough to be
18 within the risk or hopefully low enough to be within
19 the risk limit.
20 COMMISSIONER ROGERS: Suppose it's not?
21 DOCTOR MOELLER: If it's not, then --
22 COMMISSIONER ROGERS: But the probability
23 is still very low.
24 DOCTOR MOELLER: I'd have to think about
25 it. Sure, there could be some cases where --

1 COMMISSIONER ROGERS: It's a little bit
2 hypothetical.
3 DOCTOR MOELLER: But at last a risk-based
4 approach gives you a lot more flexibility in my
5 opinion and a lot more reasonableness, and yet you are
6 protecting the public health and safety. It does not
7 lessen that objective.
8 DOCTOR STEINDLER: Just one comment.
9 There are a couple of cutoff limits that people
10 occasionally propose and really what you're asking is
11 where do those come into play. We have, I think, in
12 the limited discussions we've had, we've not found
13 clearly acceptable governing principles on whether to
14 implement cutoff limits. Organizations have -- the
15 microrem for mega people issue has been addressed by
16 ICRP, I believe, and there is a general consensus,
17 there seems to be a general consensus that events that
18 have a probability below a certain value need not be
19 considered further. Those are clearly kind of
20 societal arbitrary cutoffs that you make.
21 COMMISSIONER ROGERS: Well, it may be that
22 being a little more explicit in your thinking to us on
23 the cutoff question with respect to this point of view
24 that you've been taking here of a risk-based standard
25 might be helpful.

1 DOCTOR MOELLER: Thank you. We certainly
2 can consider that. As you note in our letter, we did
3 have extensive interactions with a representative from
4 the National Radiological Protection Board in the U.K.
5 and they indeed have suggested cutoff limits on risk,
6 yes, or on probability. Excuse me.
7 COMMISSIONER ROGERS: On probabilities?
8 DOCTOR MOELLER: Yes.
9 COMMISSIONER ROGERS: Marty, I wonder if
10 you could just describe what the methods were that you
11 employed to identify your issues in your issues paper?
12 What was the process that floated issues up? Did you
13 sit around and scratch your noodles? How did you come
14 at this? Was it something systematic?
15 DOCTOR STEINDLER: To some extent. No, it
16 was a little bit more systematic than that. Actually,
17 we prepared several levels of diagrams for various
18 aspects. You saw the one overview that we submitted
19 with the letter in response to an urging to do so.
20 But buried underneath that, for example, were -- one
21 of the things that we put together was a detailed
22 analysis of the system of qualifying the engineered
23 barrier system. We prepared a diagram that indicated
24 to us what kinds of information had to be available,
25 where it was going to come from and how it would

1 interact into the final designation of what the
2 engineered barrier system's performance was likely to
3 be.
4 We did that explicitly for some things and
5 implicitly, you can call it scratching your head if
6 you like, for others and from that generated a much
7 larger list of issues that we thought at the time when
8 we thought about them were either unresolved or could
9 lead to difficulties. The next two processes were
10 fairly straightforward. One, we looked at the issues
11 and then prodded around the system to see whether or
12 not they in fact were uncovered. That is there was
13 nothing that we could see being done about them. And
14 then two, we did have some fairly extensive
15 discussions among ourselves as to what's important and
16 what isn't and what the role of these various issues
17 are. So, we eventually narrowed that down
18 considerably and we had a discussion with the Chairman
19 on a list that included a number of items that did not
20 make the final cut.
21 CHAIRMAN SELIN: Their chairman.
22 DOCTOR STEINDLER: Yes, I'm sorry. And
23 the logic for throwing those out seemed eminently
24 sound to us in essentially all the cases. That's the
25 mechanism we used to eventually get down to the final

1 list.

2 The final list has a number of strange
3 attributes. Frankly, I'm not as happy with that list
4 as I might be on a personal basis, largely because it
5 tends to be almost non-technical. The specific
6 technical issues that you and others have prodded us
7 to think about simply don't show up in a series of
8 issues where the question is, "Tell me something about
9 major show stoppers." We didn't see any. You know,
10 the thermodynamics seemed reasonable. You can build
11 a repository. We think we know and the staff knows
12 what to look for when somebody says, "I've got
13 corrosion rate data which show that a six inch thick
14 canister is going to do the job for X years."

15 The detailed data for that may not be at
16 hand at the moment, but it looked to us that people
17 know how to go about getting it and people are in the
18 process of getting the data. We didn't think that
19 that kind of issue should be raised, but we don't
20 think that's a show stopper. If it were 1998 or the
21 year 2003 and those data were not at hand and it
22 didn't look like anybody was going to get there, then
23 we might raise for the Commission that as being, "Hey,
24 it's way too late." But that's not the place we're
25 in.

1 COMMISSIONER ROGERS: Well, I wonder
2 though if -- this is very interesting to me and I
3 think might be very useful for us at a later date to
4 review the process that you've gone through here
5 because this seems to me to be a process that maybe
6 should be revisited sometime by another Commission at
7 a later date. The approach that you've taken, rather
8 than just the results of the issues that you've
9 finally winnowed out of this from this process seems
10 to me equally interesting to the results themselves.
11 DOCTOR STEINDLER: We were explicitly
12 told, thankfully, that weren't going to have to do the
13 systems analysis because we would figure that would be
14 an enormous task. So, the examples that we picked
15 were simply examples out of our own experience. We
16 were looking forward to seeing the DOE-completed
17 package where most of the steps for that kind of a
18 process should be fairly evident and from that we
19 could then do the job that we had to do ourselves in
20 several areas. I'm still hoping that that will be the
21 case.
22 When we do that, I for one would like to
23 go back and see what they've done and see whether or
24 not we've got a reasonably complete package. We may
25 come back to you at some time saying, "Oops, we missed

1 a few things." We don't think so. We think we're
2 well enough acquainted with the system at large and
3 we've talked to a lot of people so that we don't think
4 there are any holes in that. The staff has not given
5 us any indication that we've missed something
6 horrendous and we have a reasonably good working
7 relationship with the staff.
8 COMMISSIONER ROGERS: Thank you.
9 CHAIRMAN SELIN: They're not going to tell
10 there's something horrendous and have a whole --
11 DOCTOR STEINDLER: They have not been
12 particularly hesitant in telling us where they think
13 we're not on the right track.
14 CHAIRMAN SELIN: Doctor Hinze?
15 DOCTOR HINZE: Well, a good example of
16 trying to look for the show stoppers was the
17 occurrence of the Little Skull earthquake this past
18 summer in the immediate vicinity of the repository.
19 We gave that a great deal of thought. Paul and I are
20 extremely interested in that, visited a tunnel which
21 is just above the epicenter and we were looking at
22 that as a possible show stopper. But indeed the DOE
23 is doing an adequate job of investigating that and is
24 on track, we believe, with their analysis. That's
25 been stepped up, as you've heard from Carl Gertz. So,

1 we just couldn't provide that as an item to include in
2 here. But a lot of investigations have gone into this
3 that have unfortunately, if you will, dead ended.
4 We've looked at these in terms of the early site
5 suitability evaluation, the work of the staff in
6 relationship to this and with our own view on these
7 topics.
8 CHAIRMAN SELIN: Commissioner Curtiss?
9 Commissioner Remick?
10 COMMISSIONER REMICK: Yes. I don't think
11 I have to say that I agree with your risk perspective
12 and I think on the large consequence, low probability
13 one has to limit the probability when you get down to
14 the area of striking meteorites or asteroids and
15 things like this. The comparative type of thing has
16 to enter in.
17 The thing that I had difficulty with was
18 your suggestion that assuming a probability of one for
19 intrusion, certainly my trips out West I always am
20 just amazed how big that is. To think that a hundred
21 acre site, that the probability is one that sometime
22 somebody will come in there and drill and breach, I
23 don't know what the probability is, but to me it has
24 to be less than one if you look at the space in this
25 country and the probability of that being selected.

1 But I don't know what the probability is. All you're
2 doing is assuming that it's perhaps a reasonable thing
3 from a conservative --
4 On the question of how do you prevent that
5 type of intrusion, there have been a number of things
6 that have been around a long time, pyramids. You go
7 to Upsula, Sweden, you see the burial mounds for
8 Viking kings that have been there a long time. You go
9 to Korea you'll see the burial mounds for kings there.
10 Everybody seems to know that they're there and they've
11 been a long time and so forth. So, the thought went
12 through my mind, well, maybe we should build a pyramid
13 on top of the repository. Then I thought, "No, that's
14 probably expensive." I came up with another idea.
15 Maybe we should establish a government agency at the
16 site. They never go away. But then I conclude that
17 that would probably be more expensive, so I came back
18 to the idea of something like a pyramid.
19 Why isn't it possible to conceive of
20 something like a burial mound or a pyramid or
21 something like that?
22 Also, I just came back from observing the
23 enhanced participatory rulemaking out in San Francisco
24 and listened to Russell Jim from the Yakima Indian
25 Nation who, by the way, was in the United Airline

1 commercial back some months ago. A very interesting
2 person. But he made a very impassioned plea. It had
3 to do with storing low-level waste on sites,
4 particular Hanford, but pointing out from their
5 standpoint that they've had thousands of generations
6 in which things are passed down from person to person
7 and he claims that there's something there. That's
8 passed down by word of mouth. Now, we're not all from
9 the Indian nations and therefore don't always live on
10 the land.
11 But I have a tough time feeling that there
12 isn't some way with the record keeping ability we have
13 today, even if the United States was somehow
14 destroyed, I'm sure the people in Europe would know
15 that we would have had a site like Yucca Mountain and
16 so forth. It just doesn't seem possible to me that
17 the records of such a unique type of site would be
18 lost and that there isn't a way of ensuring that. I
19 have a difficult time assuming that there's just no
20 way of identifying those sites. If we're talking
21 about intrusion from the standpoint of somebody
22 walking the site, no question about that. If we're
23 talking about somebody going in there and drilling, I
24 certainly can't necessarily preclude it, but I'm not
25 sure you can't prevent it to a large extent.

1 DOCTOR POMEROY: Can I make two comments
2 on that?
3 COMMISSIONER REMICK: Yes, please.
4 DOCTOR POMEROY: One is, of course, the
5 pyramid question has been considered extensively and
6 some of the internal structures in the pyramids have
7 been effectively looted at one point in time.
8 COMMISSIONER REMICK: Sure. Sure.
9 DOCTOR POMEROY: So, there has been
10 intrusion into the pyramids. In fact, they tend to
11 attract people's attention in the sense that --
12 COMMISSIONER REMICK: I'm talking about a
13 pyramid above ground and a repository is a couple
14 thousand feet below that.
15 DOCTOR POMEROY: But wouldn't another
16 argument be made that if that pyramid is out there,
17 it's probably marking something extremely important
18 and perhaps very valuable --
19 COMMISSIONER REMICK: Sure.
20 DOCTOR POMEROY: -- and therefore perhaps
21 we should look, we should intrude.
22 COMMISSIONER REMICK: My argument would be
23 that the record of what is there would certainly
24 presumably be known. In other words, the people
25 looted because they knew the kings were buried in

1 there, right, and there was loot in there.

2 DOCTOR POMEROY: The other comment I would

3 make is that, as you know, there have been various

4 nuclear tests conducted offsite, off the Nevada test

5 site, specifically in Central Nevada. You and I

6 probably could go there today and I would suspect we

7 could at least wildcat drill immediately into that

8 area. There's almost no physical marking in the area.

9 There probably is a record someplace, but I suspect

10 that record for that single test event will get

11 progressively more lost in time and I think that

12 that's --

13 COMMISSIONER REMICK: That's because no

14 effort is being made to mark it.

15 DOCTOR POMEROY: That's correct. In fact,

16 the efforts to mark it were minimal to start with.

17 COMMISSIONER REMICK: Yes.

18 DOCTOR POMEROY: And they have

19 progressively decreased. There was a fence at one

20 time. Now there's no longer a fence. There was a

21 sign, now it's sort of faded and difficult to read.

22 That's only 20 or 30 years ago.

23 COMMISSIONER REMICK: Yes. But once

24 again, there was not a real intention to mark it. I

25 just don't think you can remove the possibility of

1 marking things.

2 DOCTOR POMEROY: Oh, I think markers are

3 important, but I'm not sure they're a perfect

4 solution.

5 COMMISSIONER REMICK: No, they're not.

6 Nothing is perfect.

7 DOCTOR STEINDLER: Let me just make the

8 comment that the focus of the regulations are not

9 necessarily to agree on what the real world can do.

10 On the contrary. We take extreme positions and

11 scenarios in order to see whether or not the system

12 that we've designed could withstand it. I don't think

13 any reasonable person would disagree that you ought to

14 be able to mark this area for extremely long periods

15 of time. But that's not the way the regulations tend

16 to be written. They tend to be written for those

17 events far out, and it gets back to Commissioner

18 Rogers' issue, that seem unlikely on the surface but

19 whose consequences could be pretty severe.

20 It's in that context that we're stuck in

21 a sense by having generated the policy of doing that,

22 looking at microrem for mega people, looking at some

23 arbitrary and argumentative issues on where do you cut

24 your probabilities off and whether or not you can mark

25 a high-level burial ground or for that matter you ask

1 the same question that New York and the other low-
2 level burial sites that have been currently
3 essentially abandoned or they're no longer in
4 business.
5 Is the Sheffield site going to allow its
6 markers to remain there for prolonged periods of time?
7 Highly likely. But yet people worry about them
8 disappearing.
9 COMMISSIONER REMICK: No, I understand.
10 DOCTOR STEINDLER: That the county court
11 records are suddenly lost. It's possible, but it
12 seems unlikely. The issue only comes when we make the
13 extreme assumptions and then we're stuck with that.
14 COMMISSIONER REMICK: Right. And my point
15 is I think the extreme assumption of assuming that a
16 probability of one is extreme in my mind also.
17 DOCTOR STEINDLER: Yes.
18 CHAIRMAN SELIN: I just wanted to make a
19 couple of comments. One thing I think you might do,
20 one thing I think you have done but you might think
21 about making the part more explicit.
22 The thing that you might do is take a look
23 at following the basic rule of systems analysis.
24 Doctor Steindler, you said you didn't want to do any
25 because they're complicated, but this part is very

1 simple. That sort of stuck with what you think you
2 know and then solve for what you don't know instead of
3 following a more logical conclusion. You certainly
4 would have a much clearer idea of what the
5 characteristics of a particular engineered facility
6 might be a few thousand years from now than you would
7 what the far field effects would be or the geology.
8 So, when you're talking about these
9 defense in depth questions and doing the analysis,
10 it's not a bad idea to say, "Well, let's just assume
11 that the barrier had these characteristics," and then
12 how much more would we spend to try to reduce the
13 uncertainty in some of these fairly artificial
14 calculations to begin with? There are other places
15 where it's not a philosophical argument about defense
16 in depth versus putting all your eggs in one basket,
17 but as Commissioner Rogers said, if I understood him
18 correctly, how much you want to spend at the margin to
19 reduce some uncertainties which are basically
20 calculational or definitional in the first place.
21 The second question, one thing you've
22 done, which I find very useful, is to take a look at
23 the rules and see if you come up with things that
24 violate the intuition to see if we should go back and
25 take another look at the rules. The carbon-14 issue

1 has always been one of them. There are a number of
2 things that you've done. But it would be good if you
3 did that a little more explicitly as you go into these
4 points where we're looking for safety and some
5 assurance. We're not looking to just set down some
6 definitions and then slavishly carry them out.
7 So, as you come to conclusions which most
8 reasonable people would say don't have much to do with
9 health or safety, then you lead us to go back to look
10 at the rules, be they our rules or EPA standards or
11 DOE.
12 The general thing, you sort of seemed
13 unhappy that you couldn't find technical issues that
14 were as important as management issues, behavioral
15 issues, philosophical issues or definitional issues.
16 I think that's a great strength. I think you're
17 actually characterizing a current situation where the
18 scientific issues just are not the most pressing at
19 this point. As you pointed out, later on in the
20 process progress has to be made on these, but the long
21 lead issues, the real potential show stoppers, are not
22 ones that are amenable to a physicist's analysis.
23 Also, you know, I've sat next to
24 Commissioner Remick for almost two years now. I've
25 never heard him so poetic or so philosophical.

1 There's got to be something in your presentation that
2 brought it out today. I find it stimulating also and
3 I've enjoyed this very much. I think it's been
4 particularly useful to continue to follow this top-
5 down approach that you've taken to keep looking for
6 issues that really have to be attacked as opposed to
7 just trying to do something a little better or in a
8 little more depth than the other people are doing it.
9 So, I think we can all thank you very
10 much.
11 COMMISSIONER ROGERS: Yes, very much.
12 (Whereupon, at 10:33 a.m., the above-
13 entitled matter was concluded.)
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CERTIFICATE OF TRANSCRIBER

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

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

PLACE OF MEETING: ROCKVILLE, MARYLAND

DATE OF MEETING: FEBRUARY 26, 1993

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

Carol Lynch

Reporter's name: PETER LYNCH

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

February 17, 1993

MEMORANDUM FOR: Samuel S. Chilk, Secretary

ATTN: William Hill, SECY

FROM: John T. Larkins, Acting Executive Director, ACRS/ACNW

SUBJECT: ACNW MEETING WITH NRC COMMISSIONERS - FEBRUARY 26, 1993

The next meeting between the Commissioners and the ACNW is scheduled for Friday, February 26, 1993 from 9:00 a.m. until 10:30 a.m. It is our understanding that the Committee has been requested to discuss two of its recent reports which are attached. These reports are:

1. "Significant Issues in the High-Level Waste Repository Program," ACNW Report dated December 1, 1992 (Martin J. Steindler will lead the Committee's discussion)

2. "Issues Raised in the Energy Policy Act of 1992, Section 801," ACNW Report dated February 5, 1993 (Dade W. Moeller will lead the Committee's discussion)

Any guidance you can provide regarding specific questions the Commissioners may have regarding these topics would be helpful. It would also be helpful if you would inform us of any additional issues the Commissioners would like the ACNW members to address.

John T. Larkins

John T. Larkins, Acting
Executive Director, ACRS/ACNW

Attachments:
As stated

cc: ACNW Members
ACNW Staff

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

December 1, 1992

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

Dear Chairman Selin:

SUBJECT: SIGNIFICANT ISSUES IN THE HIGH-LEVEL WASTE REPOSITORY PROGRAM

The Advisory Committee on Nuclear Waste (ACNW) was asked at a meeting with the Commissioners to continue to identify significant issues that have the potential for delaying or otherwise interfering with the timely development of a repository for high-level nuclear waste (HLW). The ACNW focused on items of large scope that could hinder the development of an HLW repository, severely impact the schedule set by the Department of Energy (DOE), or disrupt the orderly licensing process by extensive delays or untimely polemics. In addition, the ACNW was asked to provide an outline of the process of developing an HLW repository. The following is in response to these requests.

The issues that appear to qualify for inclusion in this communication constitute a fluid assembly because various parties to the HLW repository program are engaged in ongoing analytical studies, research, development, demonstration, full-scale tests and the like. Further, many studies and other activities are not clearly visible or the outcome of these efforts is not predictable. Therefore, we provide this communication with the caveat that the issues believed to be important today may not be so in the near future. In addition, the Committee provides a summary in which the issues cited in this communication are ordered by the Committee according to their impact on the outcome of the repository development process. Finally, the impact of the recently passed legislation under the Energy Policy Act of 1992 is likely to result in further uncertainties about the relevance of some of the issues raised in this communication.

1. A number of issues have been identified under the heading of regulatory considerations pertinent to site characterization and licensing of a repository.

a. The NRC staff should develop positions that can serve as a basis for recommendations to the National Academy of Sciences (NAS) relative to the Academy's role, mandated by the Energy Policy Act of 1992, of providing findings and recommendations on reasonable standards for the protection of public health and safety for the proposed HLW repository at Yucca Mountain.

b. It is likely that regulations, issued by the NRC and other agencies, will not be wholly compatible or consistent. It is not clear what constitutes resolution of the issue of compatibility and the stage at which this should be accomplished. The Commission should request the NRC staff to clarify this issue and, if appropriate, initiate rulemaking.

c. The DOE has promulgated 10 CFR Part 960 but its relationship to 10 CFR Part 60 as far as the licensing process is concerned is not clear. There may be a need to clarify this relationship, especially in light of the emphasis of the DOE on 10 CFR Part 960 in its Early Site Suitability Evaluation to the exclusion of inferences from 10 CFR Part 60. The Commission should request the NRC staff to identify the role, if any, of 10 CFR Part 960 in the licensing process.

d. Considerable data that are useful or necessary for a licensing application and are anticipated to be involved in the licensing process will be or have been obtained without use of the rigorous quality assurance (QA) procedures now being implemented. The Licensing Support System (LSS) has been established to encompass pertinent data but has not yet been inaugurated. Further, the LSS may contain data or results that have similar deficiencies. Also, the guidance for the application of QA procedures to development and validation of models, and to decision-making among competing conclusions is at present substantially absent. The inclusion of QA-deficient data or protocols in selection, validation and evaluation of uncertainties in models could pose significant difficulties in the licensing process. The Commission should request the NRC staff to initiate a comprehensive review of the guidance to the DOE that is necessary to define the quality requirements for the use of all important data obtained prior to promulgation of the QA requirements and for relevant models developed for the licensing-related repository description.

e. Expert judgment will be a necessary and important part of the licensing process. Acceptance of expert judgment, its methodologies and its results in the waste management arena continues to be controversial and could disrupt a licensing process. The Commission should request the NRC staff to proceed with rulemaking to delineate the processes and standards for application of expert judgment to ensure that this technique can make a useful contribution to the licensing process and that its application will be accepted in an adversarial setting.

f. The NRC staff has apparently taken the position that performance enhancement of the engineered barrier system (EBS) cannot be used to offset the potential deficiencies likely to be encountered in the geologic media. This position has caused significant concept and design difficulties, appears to be without technical justification and also appears to be without bases in regulations.[1] Owing to the inability to predict for any site if all of the attributes will meet all regulatory requirements, the Commission may wish to examine this position to ensure that the DOE is not burdened with a requirement that is neither necessary nor feasible to implement, and with one that contributes little additional assurance of protection of the health and safety of the public. The Commission should instruct the staff to devise means to ensure that major improvements in the EBS can and should be used to offset inadequate retention/confinement properties of the geologic environment of the waste. The NRC staff should identify functional criteria for such trade-offs.

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[1]As specifically stated in 10 CFR 60.112, it is the total system that must be judged in terms of meeting the regulatory requirements, i.e., "... The geologic setting shall be selected and the engineered barrier system ... shall be designed to assure that releases of radioactive materials to the accessible environment following permanent closure conform to such generally applicable environmental standards for radioactivity as may have been established by the Environmental Protection Agency ...." In addition, 60 CFR 102(e)2 indicates that "... special emphasis is placed upon the ability to achieve isolation by virtue of the characteristics of the geologic repository. The engineered barrier system works to control the release of radioactive material to the geologic setting and the geologic setting works to control the release of radioactive material to the accessible environment."

g. The properties of HLW that was previously stored in pools or dry storage and is assumed to constitute a waste form suitable for disposal in a repository are uncertain. The Commission may wish to require the NRC staff to identify those properties of the stored spent fuel that are of importance to the repository and those tests that are considered necessary for qualification of this waste as the interim storage time lengthens. Similar considerations should also be given to HLW glass that may have been stored for some time under various conditions.

h. A significant part of the licensing process for an HLW repository involves the selection and analysis of scenarios of postulated events in the repository, coupled with the application of a variety of models of the physical system. The processes by which models are designed, tested and, where appropriate, validated to be representative of the present and future behavior of parts of the repository system are not included in regulations or guidance to DOE. Particularly, the protocols for obtaining agreement that a specific model adequately describes the future state of a system have not been defined. The Commission should request the staff to define a methodology for obtaining agreement on this issue in advance of the licensing process. We recommend that this topic be included in early rulemaking, in order to provide guidance to DOE for the performance assessment process.

i. The Environmental Protection Agency (EPA) regulations have not been codified and considerable uncertainty remains about the existing standards for ^{14}C and other gaseous radionuclides. In addition, the NRC has not developed specific and comprehensive guidance to DOE on its requirements for the confinement of such radioactive material. This uncertainty could strongly influence the entire EBS design, testing and analysis. The Commission may wish to instruct the NRC staff to begin development of such guidance in the near future, recognizing that the new environmental standards will influence the details of such guidance.

j. Protocols for testing of the EBS and its components under repository-relevant conditions have been difficult to define and apparently such testing has not been conducted in a manner agreed to be satisfactory. The DOE, as well as the Center for Nuclear Waste Regulatory Analyses (CNWRA), has initiated tests that are believed to be repository-relevant. Owing to the extensive time requirements for tests whose results are to be

extrapolated over the expected life of the EBS, the Commission should initiate development of guidance, perhaps in the form of staff technical positions, on the criteria for determining when test conditions are repository-relevant.

k. The DOE has indicated that the overall performance assessment of the repository system may not include an allocation from the performance of the waste form. This approach apparently does not agree with the view of the NRC staff and has resulted in exchanges that appear to be at an impasse. Since the waste form (spent fuel, glass) is now either prepared or in the process of being prepared in facilities that are substantially completed, the Commission should request the NRC staff to clarify the details of this disagreement and adjudicate, at an early stage, the position it wishes to take in this matter.

2. The Monitored Retrievable Storage (MRS) Facility has received attention by the Congress, DOE, various Indian Tribes, cities, counties, and States, but has not developed into an accepted project with a currently valid starting point or a schedule for its completion, licensing and operation. Owing to the pivotal position of the MRS in the disposal of spent fuel, several issues are pertinent.

   a. The required life of the MRS needs to be defined and the specifications, criteria for siting and construction, the content of licensing documents, and the anticipated licensing process need to be established, published and approved. The Commission should request the NRC staff to develop the details of regulations related to the licensing of an MRS.

   b. There has been no substantial development of a backup concept to the MRS in the event that it is not feasible to locate, site, license, or operate such a facility. While the reasons for such a failure will be non-technical, their effect could be profound. There has been little planning for this eventuality, and the Commission should request the NRC staff to initiate such studies in cooperation with the DOE and the Office of the Nuclear Waste Negotiator.

3. The scientific/technical investigations for the repository program being conducted by DOE are aimed at a comprehensive licensing document for NRC review. The studies that have been completed and those that are in progress are likely to produce results of variable quality or applicability. Further, there

will certainly not be enough time and resources devoted to these studies to provide full insight into all scientific/ technical questions. The NRC staff has commented on the Site Characterization Plan (SCP) prepared by the DOE and has provided DOE with a significant list of issues to be resolved. This list is in the form of the Site Characterization Analysis (SCA) issued by the NRC. The Commission should initiate inquiry about the importance to the function of NRC of having all of the issues and questions raised in the SCA resolved to the satisfaction of the NRC staff on a time schedule commensurate with licensing needs. Similar questions should be answered regarding the importance of having all study plans which are based on the contents of the SCP completed and submitted to the NRC staff before work on the associated topics is initiated.

4. The post-emplacement process for a repository involves a period during which the repository is to be monitored and for which retrieval of the waste is to be planned.

   a. There are no criteria for the thermal and other measurements that are to be made during this period. The Commission may want to explore the need for such criteria and, if found necessary, request the NRC staff to develop and promulgate them in order to ensure that technologies for data acquisition and interpretation can be provided in a timely fashion for the design of the EBS and the repository.

   b. The need to retrieve the waste after emplacement and backfilling influences the design of the repository and the EBS. The staff has not defined what type of retrieval will be required, the extent to which retrieval is likely to be needed, under what conditions retrieval is to be practiced, or the standards and criteria that would govern the retrieval. Owing to the importance of these issues to the design of the repository, the Commission should encourage the NRC staff to define more closely, prior to licensing, criteria for the various parts of the emplacement and retrieval process, the monitoring protocols that are expected to be applied by DOE, and the regulations that are needed for this part of the HLW disposal system.

SUMMARY:

A review of the HLW disposal system, its development by DOE, and the regulatory structure emplaced by the NRC and the EPA resulted in identification of issues that can be arranged under several major headings and subheadings. These are listed below in general order of decreasing impact on the successful and timely development of a functional repository.

A. Regulations and Guidance

		Report Section
1.	NRC Recommendations to the NAS	(1a)
2.	EBS Performance and Natural Barriers	(1f)
3.	Protocols for Use of Expert Judgment	(1e)
4.	Model Selection and Qualification	(1h)
5.	QA Applied to Models and Data	(1d)
6.	Condition of Aged HLW	(1g)
7.	Relevance of Waste Form Performance	(1k)
8.	Repository-Relevant EBS Testing	(1j)
9.	Regulations for Gaseous Radionuclides	(1i)
10.	Regulatory Consistency	(1b)
11.	Role of 10 CFR Part 960	(1c)

B. Completion of SCP Comments and Study Plans (3)

C. Post-Emplacement Regulations

1.	Retrieval of HLW	(4b)
2.	Thermal and Other Measurements	(4a)

D. Monitored Retrievable Storage Facility

1.	Definition of Licensing Process	(2a)
2.	Back-Up to MRS	(2b)

The importance of rulemaking as a process that can remove from contention selected aspects of the licensing process appears to be rising. This is particularly true as the development of experimental methods, scenarios, and experimental results is proving to be a much slower process than originally envisioned. The following topics for potential rulemaking have been identified in this communication.

1.	Consistency between EPA Standards and NRC Regulations	(1b)
2.	Protocols for Use of Expert Judgment	(1e)
3.	Model Selection and Qualification	(1h)

The Commission should initiate a more aggressive rulemaking process and seek to complete, at an early date, those rulemaking items that

impact the repository design and the development of experimental data. In addition, we provide this response with the recognition that additional considerations could be added. Further, we plan to review and continue monitoring the results of systems analyses being conducted by DOE and its contractors. The schedule of these efforts may allow a report on their status before the end of this fiscal year.

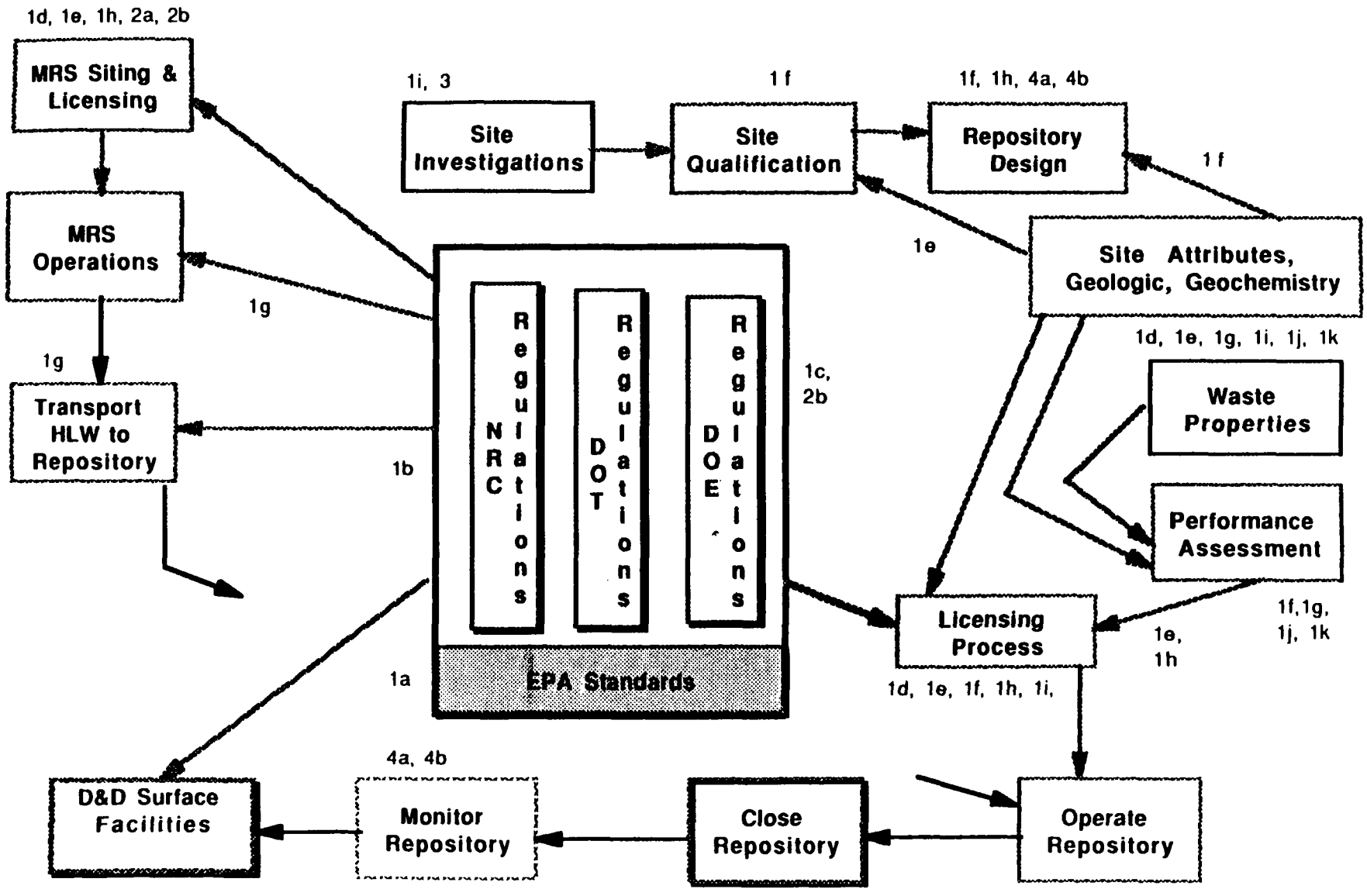
Sincerely,

Dade W. Moeller

Dade W. Moeller
Chairman

Enclosure:
HLW Relational Diagram

HLW Relational Diagram.



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

February 5, 1993

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

Dear Chairman Selin:

SUBJECT: ISSUES RAISED IN THE ENERGY POLICY ACT OF 1992, SECTION 801

During its 50th meeting, January 27 and 28, 1993, the Advisory Committee on Nuclear Waste (ACNW) met with representatives from the U.K. National Radiological Protection Board, the U.S. National Council on Radiation Protection and Measurements, and the NRC Staff to discuss the three principal issues that the National Academy of Sciences will be addressing in response to the assignment outlined by the U.S. Congress in the Energy Policy Act of 1992.

The Committee did not have an opportunity to review SECY-93-13, which presents the NRC staff analysis of these issues. The comments that follow are primarily based on discussions held during our meeting.

In considering Section 801 of the Energy Policy Act, it is important to note that the charge to the National Academy of Sciences involves the development of standards that are intended to be site specific for the proposed repository at Yucca Mountain. As we interpret it, these standards, to be developed by the U.S. Environmental Protection Agency (EPA), will be used to guide the design and to define compliance of this repository. In this regard, we offer the following observations:

a. Environmental standards are most useful when formulated without reference to a specific site. We interpret Section 801 of the Energy Policy Act as calling for the development by EPA of "generally applicable standards" but for the proposed Yucca Mountain site. This should provide EPA sufficient flexibility to avoid the development of standards that would be unnecessarily site specific. In making corresponding changes to 10 CFR Part 60, the Commission should similarly avoid, wherever possible, developing regulations that are uniquely applicable to the Yucca Mountain site. The regulations should be based on assumptions or conditions that have a sound foundation in the pertinent technical disciplines and methodologies.

b. Regardless of the form of the standards, we believe that they should be geared to specific time periods in the future. For example, such periods might include one during which it is reasonable to assume the presence of institutional controls, a second during which it is assumed that the biosphere will be comparable to the present, and a third that extends so far into the future that the associated predictions have such unacceptably large uncertainties as to compromise their usefulness. The Commission may want to encourage this type of approach.

c. Fundamental to the standards should be a provision that individuals and populations in the future are accorded a level of protection at least equivalent to that which is accorded to individuals and populations alive now.

ISSUE ONE

"Whether a health-based standard based upon doses to individual members of the public from releases to the accessible environment will provide a reasonable standard for protection of the health and safety of the general public"?

In response to this inquiry, our answer is "Yes." In support of that view, we offer the following comments:

a. We interpret a "health-based standard" as incorporating a "risk-based standard." In this sense, such an approach would represent a major step forward in that risk is a more fundamental criterion than dose for the protection of members of the public. Although a risk-based standard could incorporate a limit on the dose, it should also reflect the possibility that the limit could be exceeded. Setting the standards on the basis of risk would also avoid having to revise them as newer data on the health effects of radiation are developed. In addition, application of a risk-based standard makes it possible to compare the risks of radionuclide releases from a high-level waste repository to the risks from other environmental contaminants.

b. Interestingly, this approach, if adopted, would place an annual, versus cumulative, limit on permissible doses to members of the public. In incorporating this approach, however, it is important that the limit include application of the concept of the "critical group," rather than the concept of the "maximally exposed individual." Benefits of the concept of the "critical group" are that it ensures not only that members of the public will not receive unacceptable exposures, but also that decisions on the acceptability of a practice will not be prejudiced by a very small number of individuals with unusual habits.

c. A standard containing a radionuclide release limit avoids the necessity to estimate environmental radionuclide transport and associated human intake. [However, determining compliance with such a standard through environmental monitoring would be very difficult, as would be comparing a release limit to the impacts of other radiation sources (e.g., natural background).] An environmental standard should have broad application; one that incorporates radionuclide release limits is useful only as a guide for design.

d. Limits on individual doses should not be used as a justification for selecting poor repository sites. For certain proposed sites, it could theoretically be possible to exceed a dose limit for individual members of the public due to the fact that there is very little water available. A "risk-based" standard would help to overcome this problem by making it necessary to take into consideration the probability that the individual dose limit might be exceeded. At the same time, limitations on the quantities of water available would restrict the number of people who could be exposed, and the associated collective doses (or societal impacts) of the radionuclide releases. In this regard, it should be noted that collective dose estimates beyond several generations are not very useful due to a lack of information on the number, or the living habits, of people who might live in a given area.

ISSUE TWO

"Whether it is reasonable to assume that a system for post-closure oversight of the repository can be developed, based upon active institutional controls, that will prevent an unreasonable risk of breaching the repository's engineered or geologic barriers or increasing the exposure of individual members of the public to radiation beyond allowable limits"?

In response to this inquiry, our answer is "No." Supplementing this response, we offer the following comments:

a. As a basic premise, we believe that the assumption of institutional control (or oversight) for extremely long periods of time is neither practicable nor workable. It is imperative that the assumption of post-closure oversight not be used as a justification for lessening the stringency of the repository design.

b. Reliance on active controls also has the disadvantage of conceivably leading to acceptance of an otherwise unsatisfactory disposal facility, because it could be assumed that unacceptable radionuclide releases would be detected and mitigated by active controls.

c. The post-closure phase presents an opportunity to continue to monitor the performance of the repository and to gather data that could be useful in the siting and design of similar facilities in the future. Although we share with the NRC staff the concerns that intrusive monitoring equipment is not acceptable, we believe that technologies could be developed for collecting data through remote sensing operations or electrical connections that will not negate the integrity of the repository. Key parameters on which data might be collected include thermal conditions, the presence of moisture, seismic events, and radionuclide releases.

ISSUE THREE

"Whether it is possible to make scientifically supportable predictions of the probability that the repository's engineered or geologic barriers will be breached as a result of human intrusion over a period of 10,000 years"?

In response to this inquiry, our answer is "No." On the basis of our discussions, we offer the following comments:

a. As a basic premise, we believe that the design, construction, and operation of an HLW repository should be conducted using the assumption that there will be no post-closure oversight. That is to say, we believe that the design should be robust enough to ensure that such oversight is not necessary.

b. In our opinion, inadvertent human intrusion into the proposed Yucca Mountain repository over the next 10,000 years is a reasonable likelihood; in fact, we believe it is reasonable to assume a probability of one for such an event. This being the case, we concur with the Board on Radioactive Waste Management that it would be more appropriate for the U.S. Department of Energy (DOE) to base its risk assessments of human intrusion on its potential consequences, rather than its probability. Following this approach, the possibility of human intrusion should be a factor in the selection of a site and the design of a disposal facility.

c. We believe that the risk-based standards for individual members of the public should generally apply to radionuclide releases that occur as a result of human intrusions that have a probability of bypassing a portion of the repository barrier system. However, the limits should not apply to public exposures that occur as a result of actions by intruders who bypass all the repository barriers. Intruders who possess the capability to intrude into a repository in such a manner would presumably possess sufficient technological capabilities to identify any radionuclide releases that accompany such actions. The standards should include general guidance on

design considerations that might compensate for the damage to a facility caused by human intrusion and mitigate any radionuclide releases to the environment.

d. We believe that the probabilities and consequences of human intrusion should be considered outside the normal evaluation of the safety of a repository in the same manner as threats of sabotage are considered in terms of releases from a commercial nuclear power plant. For this reason, we concur with the DOE position that radionuclide releases to the accessible environment from human intrusion should be treated separately from potential radionuclide releases caused by natural processes and events.

e. In addition to the specific requirements enumerated in the statement of this issue, the upcoming National Academy of Sciences study offers an excellent opportunity to investigate the possibility of making scientifically supportable predictions of the probability that various barriers within the repository will be breached as a result of natural events over a period of 10,000 years. We strongly encourage such an effort.

We trust these comments will be helpful. The Committee plans to continue to review the impacts of the Energy Policy Act of 1992 on the disposal of high-level radioactive waste.

Sincerely,

Dade W. Moeller

Dade W. Moeller
Chairman

References:
1. SECY-93-13, dated January 25, 1993, for the Commissioners, from James M. Taylor, EDO, "Analysis of Energy Policy Act of 1992 Issues Related to High-Level Waste Disposal Standards"
2. National Radiological Protection Board (UK), "Board Statement on Radiological Protection Objectives for the Land-Based Disposal of Solid Radioactive Wastes," Volume 3, No. 3, 1992