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NUCLEAR REGULATORY COMMISSION

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ON NUCLEAR WASTE

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NUCLEAR REGULATORY COMMISSION

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PERIODIC MEETING WITH ADVISORY  
COMMITTEE ON NUCLEAR WASTE

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PUBLIC MEETING

Nuclear Regulatory Commission  
One White Flint North  
Rockville, Maryland

Thursday, December 13, 1990

The Commission met in open session,  
pursuant to notice, at 8:30 a.m., Kenneth M. Carr,  
Chairman, presiding.

COMMISSIONERS PRESENT:

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

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## STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

SAMUEL J. CHILK, Secretary

WILLIAM C. PARLER, General Counsel

DR. DADE W. MOELLER, ACNW

DR. WILLIAM J. HINZE, ACNW

DR. MARTIN J. STEINDLER, ACNW

DR. PAUL W. POMEROY, ACNW

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

2 8:30 a.m.

3 CHAIRMAN CARR: Good morning, ladies and  
4 gentlemen.

5 The purpose of today's meeting is to hear  
6 from members of the NRC's Advisory Committee on  
7 Nuclear Waste, on their activities since we last met  
8 in February of 1990. Since that meeting, Doctor  
9 Moeller has reported on 14 activities undertaken by  
10 the Committee. Today's meeting will focus on the  
11 Committee's reviews of the Environmental Protection  
12 Agency standards for high-level radioactive waste  
13 management and the staff's draft technical position  
14 on waste farms for low-level radioactive waste.

15 The meeting will also include a status  
16 report on the Committee's working groups on transport  
17 of carbon-14, human intrusion and mixed waste, as well  
18 as other potential working groups' activities.

19 Copies of Committee's recent letters  
20 related to today's topics are available at the  
21 entrance to the meeting room. I welcome the  
22 distinguished members of the Committee, especially  
23 Doctor Paul Pomeroy who is joining the Committee in  
24 his first meeting with the Commission since he was  
25 appointed last summer.

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1 Do my fellow Commissioners have any  
2 opening remarks?

3 If not, Doctor Moeller, please proceed.

4 DOCTOR : Thank you, sir.

5 We'll begin then, as you pointed out, with  
6 a discussion of where we stand on the EPA standards.  
7 As you well know, this has been an ongoing issue  
8 within the Advisory Committee. Although we agree that  
9 perhaps -- or we realize that perhaps not everyone  
10 agrees fully with some of the positions that we have  
11 taken, we believe that the questions we have raised  
12 have been beneficial, not only in stimulating the  
13 staff to take a more questioning look at their ability  
14 to confirm conformance of a specific repository with  
15 the EPA standards, and we also believe the questions  
16 we have raised have been beneficial, hopefully to EPA  
17 as exemplified by the letters that we have exchanged  
18 with Mr. Guimond.

19 Where do we stand today? We still believe  
20 that the standards are overly stringent. This is  
21 certainly true if one takes a global view, as the EPA  
22 does, and as they did in formulating the standards.

23 We have been asked to justify our position  
24 or, say, even to quantify our position and there are  
25 several ways in which you can do that and there are

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1 several ways in which you could show the opposite to  
2 be true. I'll try to just take a few minutes and  
3 cover some of each.

4 One of the basic goals of the EPA  
5 standards is the limit of no more than 1,000 deaths  
6 or health effects within a 10,000 year period. Now,  
7 if you look at that in terms of a global view and  
8 calculate the doses that are involved and the doses  
9 which lead or which they use in calculating a  
10 collective dose to estimate those thousand effects,  
11 you find that those doses are really infinitesimal.  
12 They're far below -- well, I believe Doctor Steindler  
13 computed it as two parts per million, or something  
14 like that, of natural background. We all realize  
15 though that they are very low. So, in that sense, the  
16 standards are very conservative.

17 You mentioned carbon-14 which we're now  
18 reviewing and which Doctor Steindler will be talking  
19 about. If you look at the release limits for carbon-  
20 14, that's another very clear example of where we  
21 believe the standards are far overly stringent and  
22 I'll leave to Doctor Steindler to elaborate on that.

23 COMMISSIONER REMICK: Excuse me, Dade.  
24 Can I ask a question relating to the doses? Am I  
25 correct that EPA had integrated those doses out over

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1 the total world population?

2 DOCTOR MOELLER: We believe that to be  
3 true. Now, you also find, and that was one of the  
4 last things I was going to say, but I'll say it now,  
5 that there is a lack of documentation of exactly how  
6 and what EPA has done in each case. Of course, in Mr.  
7 Browning's letter to Mr. Guimond, I guess it was,  
8 commenting on draft two of the EPA standards, he  
9 pointed that out, that you need to document your  
10 position. You need to provide or be able to provide  
11 people with written reports that show what you did.  
12 Particularly, again we're not lawyers, but when you  
13 get into the licensing arena down the road on the  
14 repository, we presume that everything EPA did is  
15 going to have to be documented. As of this moment,  
16 it's not. We'll show you an example in a few minutes.

17 I use another example to show you the  
18 perspective on the 1,000 deaths in 10,000 years and  
19 I don't know if this is a good one or not, but EPA is  
20 responsible, as you know, for indoor radon as well as  
21 for the repository and they estimate 20,000 deaths a  
22 year from indoor radon in the United States. I don't  
23 know how much effort they're putting on radon compared  
24 to how much effort they're putting on the repository,  
25 but the thousand deaths in 10,000 years for the

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1 repository are the number of deaths, number of people  
2 being killed every three weeks on the basis of the  
3 same agency's calculations for radon. At least that  
4 provides some perspective to me.

5 It also must be recognized, and this is  
6 what Commissioner Remick was just pointing out, that  
7 the thousand deaths, as we understand it, that EPA has  
8 estimated for their repository and for the standards  
9 for that repository are based on collective doses  
10 based upon micro-rem to mega-people.

11 The premier advisory committee on  
12 radiation protection in the United States, in my  
13 opinion, is the National Council on Radiation  
14 Protection and Measurements, and they have clearly  
15 pointed out without any qualification whatsoever, and  
16 they have fully justified their position, that in  
17 calculating collective doses you should truncate at  
18 a level from one millirem per year and below, that  
19 those numbers do not count. Even your agency  
20 truncates in your calculations for Appendix I not on  
21 the basis of dose rate but on the basis of distance.  
22 You go out to 50 miles.

23 So, there's many precedents for showing  
24 that what EPA is doing is not fully acceptable within  
25 the rad protection community.

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1           Now, other groups have made calculations  
2 that show that the standards that EPA has proposed are  
3 overly stringent. One of the typical calculations  
4 that's done is you assume that the repository releases  
5 the quantities of the radionuclides in Table 1 equally  
6 each year over either the 9,000, if it's after 1,000  
7 years, or the 10,000 year period. You have that be  
8 diluted in groundwater, say, at Yucca Mountain. Well,  
9 if you dilute it in a small enough volume of  
10 groundwater and have someone drink two liters a day,  
11 you can estimate doses up in 10, 20, 30 rem per year  
12 to the person drinking that groundwater.

13           Now, that is a paper exercise. Of course,  
14 you could say by choosing a dry site you've penalized  
15 yourself. If there's only one gallon a year of  
16 groundwater that escapes from Yucca Mountain, then  
17 you're in worse shape than if there's 10,000 gallons.  
18 So, if you follow the philosophy of this particular  
19 approach in trying to demonstrate that the standards  
20 are overly stringent, you would say the best  
21 repository would be one that's floating in a sea of  
22 water because there would be plenty of water there to  
23 fully dilute the radionuclides that are released and  
24 therefore no one would be over exposed.

25           COMMISSIONER CURTISS:     It's made to

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1 demonstrate that the standards are not stringent  
2 enough?

3 DOCTOR MOELLER: Yes, that point is used  
4 to demonstrate that the standards are not stringent  
5 enough.

6 Now, let me close out back on the  
7 documentation. We asked EPA for reports to help us  
8 and to provide us with all the background we could  
9 obtain to delve into this situation. One of the  
10 reports they provided to us was a report by Alexander  
11 Williams that is issued as an EPA report. In that  
12 report, which was issued in 1980, they took  
13 hypothetical ore body and three real world ore bodies  
14 and calculated the impact upon the public due to  
15 normal releases from those ore bodies. They actually  
16 had four cases. They took three actual ore bodies but  
17 treated one of them in two different ways.

18 If you look at those data you'll find  
19 that the releases in Table 1 of EPA standards for  
20 radium are about 1/30th of the minimum estimated  
21 release of radium from the ore body and you find that  
22 the health effects in EPA's standards range somewhere  
23 in the ballpark of 100ths to a 1,000th of the health  
24 effects from the ore body. If you go further and  
25 realize that the ore body has a chance of one of

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1 releasing its radionuclides, then you look at Table  
2 1 of the EPA standards and they say no more than one  
3 chance in ter of releasing these quantities. So you  
4 have, in our opinion, further conservatism.

5 So, to repeat, they should document their  
6 work much more carefully. We would certainly like to  
7 have better documentation for us to review and  
8 evaluate. We're certainly now open to discussion or  
9 questions on that point.

10 CHAIRMAN CARR: Commissioner Remick?

11 COMMISSIONER REMICK: From your  
12 perspective, do you see any movement on EPA's part to  
13 reconsider?

14 DOCTOR MOELLER: Yes, I do. Of course  
15 we'll invite the other members to comment. I do not  
16 see movement in terms -- well, I do too. I was going  
17 to say I do not see movement in terms of rewriting the  
18 standards, but we do.

19 Through the efforts of the staff, we  
20 have -- through their working closely with EPA and  
21 hopefully somewhat stimulated by our letters, they now  
22 are taking what's called this three bucket approach  
23 where they're looking in terms of the repository, the  
24 normal or the releases under undisturbed conditions,  
25 which you can handle probably largely in a

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1       deterministic way, and then they're looking at  
2       disturbed conditions with a reasonable probability of  
3       occurrence, and then putting in a third category,  
4       disturbed conditions that are highly improbable of  
5       occurring. We find that a major step forward.

6                COMMISSIONER REMICK:  If they adopt what  
7       you've referred to as a three bucket approach, how  
8       about our Part 60?  What does that do to that?  Is it  
9       consistent?  Will it affect our Part 60 in any way?

10               DOCTOR MOELLER:  Can someone bail me out  
11       and help me on what it would do?  We have not gone  
12       into that yet.  We are working with the staff to look  
13       at Part 60 in relation to the standards.  But  
14       specifically on that question, we have not examined  
15       it.

16               DOCTOR HINZE:  I might add, if I might,  
17       we've heard this only briefly from the staff, in fact  
18       at the Human Intrusions Workshop.  One of the very  
19       encouraging things about that is that Mr. Galpin was  
20       the first one to bring it up and asked if the NRC  
21       staff couldn't present some preliminary ideas on this.  
22       Part of our follow-up in terms of human intrusion is  
23       to look forward to interacting with the staff and  
24       others in terms of the three bucket approach and  
25       seeing what that does mean and looking at the

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1 scenarios that develop from it. So, we're just  
2 starting now.

3 COMMISSIONER REMICK: In your letter, and  
4 I think you just referred to it, Dade, that the staff  
5 made comments to --

6 DOCTOR MOELLER: Yes.

7 COMMISSIONER REMICK -- EPA as did the  
8 Committee, and in your letter I think you said  
9 something about if EPA complies with the staff  
10 comments, that would satisfy the Committee's concerns.  
11 Is that still your position?

12 DOCTOR MOELLER: Well, I think it would  
13 help satisfy our concerns.

14 COMMISSIONER REMICK: Okay.

15 DOCTOR MOELLER: That was probably  
16 somewhat an overstatement.

17 COMMISSIONER REMICK: Okay.

18 DOCTOR MOELLER: But it certainly is a  
19 major step forward. There is communication. Change  
20 is taking place. We're encouraged.

21 COMMISSIONER REMICK: Good. In one of  
22 your letters, and some of your testimony, I guess,  
23 they suggested a hierarchical structure which sounded  
24 a little bit familiar off the safety goals. But have  
25 you talked to EPA on whether they consider the

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1 standards that they proposed were set up that way or  
2 did you find that there was a possibility of setting  
3 it up? In other words, do they agree that there's a  
4 hierarchical structure to their standards? I think  
5 you pointed out that some of the subsidiary standards  
6 then of the objectives are inconsistent with the  
7 higher level. Did they indicate that they set it up  
8 in that way, hierarchical structure, or does it just  
9 kind of happen?

10 DOCTOR MOELLER: In our more recent  
11 discussions with them and with the staff, we have  
12 obtained a much clearer picture of the situation. In  
13 reading the EPA standards in the preamble and so forth  
14 to them, one could interpret that they looked at an  
15 ore body and then they set the standards so that the  
16 repository is no worse than the ore body. In reality,  
17 we're now told that yes, they looked at an ore body  
18 but then in terms of the repository they applied what  
19 they considered to be technologically feasible. It  
20 worked out so it was far better than the ore body.

21 But EPA, as I understand it, would not  
22 claim that, to use Commissioner Curtiss' word, that  
23 there's a nexus between the ore body and their  
24 standards. The standards are the standards.

25 COMMISSIONER REMICK: Yes. Thank you.

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1 CHAIRMAN CARR: Commissioner Curtiss?

2 COMMISSIONER CURTISS: I just have a  
3 couple of questions. In defense of the EPA standards,  
4 I guess there are those who make a couple of points.  
5 Number one, that the material in the repository will  
6 not be released evenly over time during the 10,000  
7 year period, that in fact because of the packages and  
8 the design of the repository itself, that you may in  
9 fact see releases that are very uneven over time,  
10 first. Secondly, that they are events beyond the  
11 10,000 year period that we need to take account of.  
12 And I guess third, more of a general comment, that  
13 this material that we're disposing of here is some of  
14 the nastiest stuff on earth and we need to ensure that  
15 we have stringent set of standards.

16 Now, on that latter point, I gather what  
17 you described here as an effort to put in context with  
18 other things that are very nasty what EPA's approach  
19 to risk is.

20 On the other two points, the question of  
21 uniform release over the 10,000 year period and events  
22 past the 10,000 year period, do you have any comment  
23 on those two points?

24 DOCTOR MOELLER: I would offer the  
25 following. There are many things about the EPA

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1 standards that are innovative and probably unique.  
2 One is that it does not matter when the release  
3 occurs. It can occur, as you say, day one or the last  
4 day or uniformly. So, that is certainly a worthy  
5 attribute of their standards.

6 In terms of beyond the 10,000 years, it  
7 brings up -- and I discussed it with Dan Fehring and  
8 he said we could mention it. He has done what he's  
9 shared with us in a preliminary way a very interesting  
10 study in which he shows that even if all of the  
11 inventory of certain specific radionuclides within the  
12 repository, you know the whatever design size it's to  
13 be, were released during -- I guess it's from 1,000  
14 until 10,000. After 1,000 years, if everything was  
15 released after 1,000 years, the inventory is not even  
16 equal for -- I would say over half of the  
17 radionuclides in the table, the inventory is not even  
18 equal to the EPA release limit.

19 Therefore, in terms of beyond 10,000  
20 years, I think it reduces my concern for all except  
21 a very few and it's plutonium and americium and maybe  
22 one or two others, maybe radium or something. We'd  
23 have to look it up.

24 COMMISSIONER CURTISS: Let me pick up on  
25 Commissioner Remick's question about what this says

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1 about the NRC regulations. As you know, the  
2 Commission's regulations are supposed to be a  
3 reasonable approximation of what's necessary to meet  
4 the EPA standards. It's a topic that was talked about  
5 extensively at the recent NAS symposium, or at least  
6 they're not to be inconsistent with the EPA standards.

7 You focused your comments here on the EPA  
8 standard and the stringency of that standard. Does  
9 that analysis tell you anything about sort of that  
10 reasonable approximation question, subsystem  
11 performance criteria in particular, or is it too early  
12 in your analysis of that issue to say anything?

13 DOCTOR MOELLER: I believe it's probably  
14 too early. We do have working group meetings  
15 scheduled to review the subsystem requirements of the  
16 NRC regulations.

17 COMMISSIONER CURTISS: Okay. That's all  
18 I have, Ken.

19 CHAIRMAN CARR: Commissioner Rogers?

20 COMMISSIONER ROGERS: Yes. What is your  
21 comment now or your feeling or sense of where things  
22 are going with respect to the use of expert opinions  
23 in judging whether the standards are being met and  
24 their relationship to the probabilistic statement of  
25 standards? In particular, I was wondering what your

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1 comments meant in the August 3rd letter that said that  
2 it may not be appropriate to treat discrepancies in  
3 expert opinions by using weighted averages unless this  
4 process has been carefully analyzed. Are you worried  
5 about averages or weighted averages? I wasn't clear  
6 there.

7 DOCTOR MOELLER: Bill Hinze or Paul,  
8 either one, they're carrying the ball on this.

9 DOCTOR POMEROY: Well, let me start off  
10 by saying that we have scheduled a series of workshops  
11 in the future that bear on the subject of expert  
12 judgment because we want to investigate the consensus  
13 or lack of consensus in the community with regard to  
14 the use of expert judgment in this entire site  
15 characterization and licensing process.

16 I can't directly address the question on  
17 the August 3rd letter, but I certainly feel that in  
18 the long run we are all going to be faced with the  
19 situation where we have a large number of issues that  
20 are going to be resolved on the basis of expert  
21 judgment. What we want to do is to ensure that all  
22 of those issues, events, processes, et cetera, that  
23 are addressed by expert judgment are clearly  
24 identified for your purposes and for the purposes of  
25 the staff.

1           We want to see that the issues are  
2 addressed with an expert judgment methodology at least  
3 that people have agreed on and we want to be sure that  
4 there are areas that we're using expert judgment in  
5 the right sense, that there are areas where we  
6 might use boundary conditions, calculations or some  
7 other form to address the question of issues that  
8 aren't resolved by the empirical data that we have at  
9 that time.

10           I don't know if that doesn't help you with  
11 the question or not.

12           COMMISSIONER ROGERS: That's all right.  
13 It may be premature, it's just that I was wondering  
14 what was in back of the comment, whether it was the  
15 concern with weighting the averages or taking averages  
16 at all.

17           DOCTOR HINZE: We're concerned about the  
18 methodology. We look at this carefully so that the  
19 proper methodology that is acceptable and that is  
20 appropriate is used. I don't think that we know  
21 enough about the situation at the present time to  
22 really get at that. But that's what the expert  
23 judgment workshops are to do, is to help us but help  
24 others as well.

25           COMMISSIONER ROGERS: Will you bring in

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1 people from NRC and Research that were involved with  
2 NUREG-1150 where that expert judgment was used quite  
3 extensively? I'm sure they could be very helpful and  
4 at least give you a perspective of their experience  
5 in using expert --

6 DOCTOR POMEROY: I would like to offer my  
7 own personal perspective on the question of the  
8 weighted averages. Certainly we are going to have to  
9 aggregate expert opinion in some way. So we are  
10 certainly going to average it, although it's not clear  
11 when you have a bipole or a distribution of expert  
12 judgment how to aggregate that.

13 I think the question of weighted expert  
14 judgment involves questions of weighting an  
15 individual's or a group's response and there are very  
16 serious methodology questions about that. How you do  
17 it and who does it are two of them that concern me  
18 greatly. In fact, it's very difficult, of course, for  
19 experts to judge themselves and to weight their own  
20 opinions.

21 DOCTOR HINZE: We're trying to remove the  
22 uncertainties by expert judgment. What we want to do  
23 is to minimize the uncertainties in the expert  
24 judgment.

25 COMMISSIONER ROGERS: Good luck.

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1 DOCTOR POMEROY: Thank you. We'll need  
2 it.

3 COMMISSIONER ROGERS: That's all.

4 CHAIRMAN CARR: I only have one question,  
5 kind of a comment. How is your -- I guess I'm  
6 concerned that the EPA sees the NRC as speaking with  
7 one voice. When the ACNW gives them comments and the  
8 staff gives them comments, how do they know who to  
9 respond to? How are you coordinating this so that  
10 EPA, in the end, will understand that, "In order to  
11 satisfy the NRC, this is what we've got to do"?

12 DOCTOR MOELLER: I'm not sure how to  
13 respond. Obviously any messages or communications,  
14 any written communications we have with EPA will go  
15 through your office. Copies will be shared with the  
16 staff. We've certainly talked with the staff on any  
17 issues that we're speaking with EPA on. So, I hope  
18 we're keeping everyone informed.

19 CHAIRMAN CARR: Okay. Well, I'd just  
20 encourage that. I certainly don't want to discourage  
21 the informal communication and what's going on, but  
22 I want to make sure that we do, in the end, speak with  
23 one voice when EPA goes over it.

24 DOCTOR MOELLER: Oh, yes, sir.

25 CHAIRMAN CARR: Any other comments on this

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1 subject? All right. Let's proceed.

2 DOCTOR MOELLER: Doctor Steindler will  
3 cover the waste form technical positions.

4 DOCTOR STEINDLER: Thank you. Let me  
5 shift from high-level to low-level waste. The subject  
6 of low-level waste is one that probably occupies more  
7 people in this country at the moment than does high-  
8 level by a significant margin and certainly is more  
9 broadly involved in a geographical sense.

10 We had been concerned at various levels  
11 of intensity about the process of generating low-level  
12 waste forms and their stability for some time. It  
13 became obvious relatively recently, within the last  
14 year or so, that at least in the cementitious waste  
15 forms there was good cause for some activity. But let  
16 me back up a little bit further.

17 There is a fundamental difference between  
18 the regulatory approach to low-level waste compared  
19 to high level waste. That fundamental difference is  
20 really significant more from a technical standpoint  
21 than it is -- the compacts aside -- than it is from  
22 any other standpoint, since we come at it somewhat  
23 from the technical standpoint.

24 The low-level regulatory base concerns  
25 itself with secondary structural effects on the

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1 stability of the waste form, which in turn then, after  
2 a few steps of logic which are perfectly decent but  
3 nevertheless are steps, gets you to the question of  
4 transport of nuclides away from the low-level waste  
5 repository, if you will, and thence to the health and  
6 safety of the public.

7 High-level waste folks have immediately  
8 addressed the issue by saying you cannot move out of  
9 that high-level waste pot more than one part in  $10^{-5}$ .  
10 The groundwater travel time, you know the subsystem  
11 requirements. That difference then focuses its  
12 attention on the waste form to a significant extent  
13 in a mechanical way. Cement, as a fundamentally  
14 important issue, both important commercially as well  
15 as important in the longrun, then became the issue of  
16 a revision of the technical position on waste forms  
17 that was put before us to review.

18 We looked at it on the 29th of August at  
19 the 23rd meeting. Let me simply outline for you what  
20 we found and some of our conclusions.

21 I've mentioned that we've looked at this  
22 problem before. Some of the prior incidents that we  
23 had occasion to at least become interested in and  
24 involved in represented a disintegration of the waste  
25 form which clearly violates the fundamental aspect of

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1 the regulations. The regulation is based on  
2 structural stability so as to avoid the accumulation  
3 of water in a bathtub. In some cases, material was  
4 incorporated into cement, which after a relatively  
5 short time failed the structural stability test. So  
6 the issue then became obvious. Cement being a pretty  
7 decent waste form commonly used, what kind of  
8 specification should there be put out by the NRC to  
9 deal with that issue?

10 The culprits, if that's the right term,  
11 tended to be fairly specific, although that's not  
12 limited to ion exchange resins. They were the first  
13 ones that brought the issue to the table and it's in  
14 that context that we looked at it.

15 The first version of the technical  
16 position that was issued as guidance for those folks  
17 who used low-level waste forms in the proper way was  
18 issued in '83. It had some problems with it that were  
19 uncovered in time. It was a perfectly decent  
20 technical position and served as excellent guidance  
21 for a fair length of time.

22 The use of cement, on the other hand,  
23 increased and, as you know, some of the compacts are  
24 currently planning low-level waste disposal activities  
25 and processes that extensively use cement and concrete

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1 as both primary and secondary containment. So, it  
2 became reasonably critical that at least that issue  
3 would be addressed. Furthermore, there's every  
4 indication that we've had and the staff has had that  
5 states are actively seeking guidance in this area.  
6 That was really the reason for that revision.

7 The revision in the technical position  
8 then addressed very specifically what had to be done  
9 in the area of cement in order to improve the  
10 likelihood that the material would meet particularly  
11 Class B and C time limits for structural stability.  
12 It also, however, added a comment that we were  
13 certainly very pleased with because we urged it,  
14 namely that in order to learn how the waste form  
15 behaved in the long haul, some sort of mishap  
16 reporting system would be incorporated into the use  
17 of various kinds of waste forms, particularly focused  
18 on cement.

19 That was included in the technical  
20 position and we recommended in a letter to you that  
21 you go ahead and authorize the -- as far as we were  
22 concerned, you could authorize the issuance of that  
23 technical position.

24 We point out, however, that that's not the  
25 end of the issue. The discrepancy between the

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1 fundamental basis of the regulations in low-level  
2 waste and high-level waste we thought was important  
3 enough to at least bring to your attention in  
4 connection with the possibility of revising Part 61  
5 to include a more direct relationship between those  
6 things that affect the health and safety of the public  
7 and the performance of the waste form.

8 We therefore recommended in that letter  
9 and we concluded that a revision to Part 61 should be  
10 contemplated that specifically talks about the  
11 resistance of the waste form to attack by groundwater.  
12 Now, as we discussed this issue, somebody correctly  
13 pointed out there is no such thing as groundwater.  
14 There are groundwaters, large plurals. On the other  
15 hand, again taking a cue from some of the activities,  
16 the methodologies in the high-level waste business,  
17 there are some generic tests that can easily be  
18 constructed which one would put into a modification  
19 of the technical position or a regulatory guide. But  
20 at least the focus in the regulation should address  
21 the issue of resistance to the transport of nuclides  
22 away from the low-level waste area.

23 We believe therefore that not only should  
24 you consider revision to Part 61, but you should also  
25 consider eventually, the staff should consider, a

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1 revision to the technical position to make more  
2 explicit tests that are required or that should be  
3 required for the movement of -- the resistance of all  
4 kinds of waste forms, not just cement, to groundwater  
5 and things of that kind.

6           The other issue which again to some extent  
7 we can learn from the high-level waste folks who are  
8 also trying to predict the future as we are in Part  
9 61 is testing requirements that deal with not the  
10 material that you made yesterday that you are about  
11 to bury tomorrow, but the material that looks like  
12 it's been sitting in the ground for 150 years or more.  
13 There the issue is technically a little more complex  
14 as again we have learned, unfortunately in a sense,  
15 from high-level waste, and that is how do you simulate  
16 aging in a time scale that you can affect reasonable  
17 experiments on?

18           That question was posed to us by ourselves  
19 and others. The answer is not very obvious. However,  
20 we have a number of possibilities for devising a  
21 reasonably focused research program that says, in  
22 effect, can we in a short time produce aged cement,  
23 for example, that we are reasonably sure of represents  
24 the material that we would dig out of a low-level  
25 burial ground 10 years from now.       The National

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1 Bureau, there are various other groups that have good  
2 capability in addressing this issue. Cement and  
3 cementitious materials are archaeologically available  
4 and their behavior and properties with reasonable  
5 extrapolation can be interpreted. So, the issue of  
6 what does the final product look like is not such a  
7 difficult one. The issue is how fast can we get there  
8 or do we have to let it age for experimentally  
9 unreasonable time periods?

10 We think that's a technical issue which  
11 is addressable and we would urge that at least the  
12 staff begin to address that issue and ultimately worry  
13 in a technical position sense about putting  
14 requirements for testing aged waste forms into a  
15 technical position or regulatory guide. Whether or  
16 not that should also be included in Part 61 is an  
17 issue which we've not addressed specifically and is  
18 a question of how you --a matter of philosophy of how  
19 you generate regulations, an issue that I leave to  
20 people who are better at it than I am.

21 So, what is our conclusion? First off,  
22 I think it should be clear that we would not recommend  
23 that you hold up the current revision of the draft  
24 technical position. It is a good revision, it's been  
25 done carefully. As we assess the situation in a

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1 limited fashion, the states and others are most  
2 interested in having that kind of guidance and it  
3 would be quite useful.

4 Secondly, we would recommend that having  
5 once issued that technical position that the next step  
6 in this process should be at least initiated, namely  
7 consider revision of Part 61 and consider revision of  
8 the technical position then issued.

9 I'd be happy to address any questions you  
10 might have.

11 CHAIRMAN CARR: Commissioner Remick?

12 COMMISSIONER REMICK: Marty, in the area  
13 of resistance of concrete over years, there has been  
14 a lot of work certainly in bore hole ceiling,  
15 extensive work in the aging of that ceiling, including  
16 concrete. I assume that was primarily structural  
17 though, not the leaching of constituents and so forth.

18 DOCTOR STEINDLER: Yes. I draw a  
19 distinction, as you might expect from a chemist,  
20 between the folks who worry about the mechanical  
21 strength and the chemical strength. We're looking at  
22 two things here. The mechanical issue I think is  
23 reasonably well addressed in the current technical  
24 position revision. The thing that concerned us was  
25 the chemistry.

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1                   COMMISSIONER REMICK:       Now, you've  
2 mentioned your recommendation, the Committee's  
3 recommendation on a standard in Part 61 on resistance  
4 to leachability and I couldn't help but note in,  
5 however, your comments on the EPA high-level waste  
6 standards that subsystem standards should only be used  
7 for guidance. Now, it appears like there's an  
8 inconsistency here. Is there?

9                   DOCTOR STEINDLER: No. My concern, I  
10 guess if I had to structure Part 61, which fortunately  
11 I don't, I would say that the Part 61 ought to  
12 identify that leach resistance should be an attribute  
13 of concern. Then I would go to the technical position  
14 or regulatory guide and identify the magnitudes of the  
15 attribute that should be considered by the applicant  
16 or whoever files in a topical report for review by the  
17 staff.

18                   COMMISSIONER REMICK: So, you see that  
19 would be just guidance then?

20                   DOCTOR STEINDLER: Yes.

21                   COMMISSIONER REMICK: Okay. Thank you.

22                   CHAIRMAN CARR: Commissioner Curtiss?

23                   COMMISSIONER CURTISS: Just one question,  
24 picking up on Forrest's comment. I must say that I  
25 approach the question or the recommendation to amend

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1 Part 61 with some degree of caution for two reasons.  
2 One, I think it's been carefully thought out. A lot  
3 of attention was devoted to that body of regulations  
4 when it was first promulgated. But two, and perhaps  
5 more currently, we're reaching a point in the  
6 compacting process where, speaking of stability, some  
7 stability in the regulatory structure I think is going  
8 to serve to benefit those states and compacts that are  
9 now developing new disposal sites. It's been awful  
10 difficult to achieve for a lot of other reasons, and  
11 so I have a couple of questions focusing on your  
12 recommendation that we amend Part 61.

13 The staff, as I understand it, took a look  
14 at the leaching question when Part 61 was promulgated  
15 in the context, as Commissioner Remick I think alluded  
16 to, of the hierarchical performance objectives that  
17 that regulation was designed to achieve.

18 I guess my question, putting it as  
19 squarely as I can, your recommendation that we  
20 incorporate a leaching criterion of some sort with an  
21 amendment to the regulations, and hence some  
22 additional guidance, is that something that in your  
23 view is essential to do in order to achieve the  
24 performance objectives or is it something that would  
25 be desirable to do because the state of the art

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1 permits us to do that, it's reasonably achievable?

2 DOCTOR STEINDLER: Well, let me say that  
3 I don't know the answer to the either/or question.  
4 It is likely that it is desirable to do because it  
5 makes more evident the focus of the regulation on the  
6 ultimate health and safety of the public. There is  
7 nothing, I think, that prevents an applicant from  
8 carrying out an analysis and including, on an either  
9 voluntary basis or whatever have you, sufficient  
10 evidence to demonstrate that the maximum exposed  
11 individual gets no more than X millirem downstream.

12 I don't think at the moment -- and I have  
13 not looked, so this is a speculation on my part. I  
14 don't think at the moment that the analyses that are  
15 being done in order to qualify a waste form include  
16 any of that information. So, the issue then is  
17 transferred over to whoever is preparing a new site  
18 either in a compact or whatever else have you. Those  
19 analyses, it seems to me, need to identify some  
20 measure of a source term in order to be able to  
21 satisfy whatever the requirements are off-site.

22 It is difficult to see how somebody could  
23 construct a source term without having some fairly  
24 good idea what the attribute of the waste form is and  
25 what that's going to look like not only today but at

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1 the end of the -- presumably the end of the period of  
2 which concern has been expressed, which varies from  
3 300 to 500 years. I think it would be highly  
4 desirable in that sense. Whether or not it's  
5 required, I would have to think about that. It's a  
6 good question that I can't give you a good answer to.  
7 But that would be the rationale that I would use.

8 Let me just add one thing. I certainly  
9 agree entirely with you that stability in regulation  
10 is a requirement. The recommendation that regulations  
11 be changed from, at least my vantage point, are based  
12 on technical issues and not regulatory issues.

13 COMMISSIONER CURTISS: Okay.

14 COMMISSIONER ROGERS: Yes. I don't want  
15 to prolong it too much, but just curious. Have there  
16 been standards established for the formulation of  
17 concrete for this particular kind of purpose as  
18 distinct from the mechanical properties?

19 DOCTOR STEINDLER: Generally not. That's  
20 not normally what concrete is used for. It's  
21 structural material. On the other hand, if you look  
22 at the potential variability, and that's an issue  
23 which I didn't touch on, perhaps I should have, the  
24 potential variability of the material that is fed into  
25 the cement before it is solidified, you can get an

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1 enormous variation in the chemistry of that final  
2 material. It's in that context, by the way, that  
3 we've made some comments about the process control  
4 program and who should be monitoring, for example, at  
5 reactors this line between the generation of the  
6 wastes to the final waste form, even the drum or  
7 whatever have you.

8 We've been a little disappointed, by the  
9 way, in that process. It's now been removed from NRR.  
10 It isn't very clear precisely who chases it down.  
11 It's no longer a matter of the tech specs of the  
12 reactors. So, changes can be made without obvious  
13 surveillance and as a consequence the product quality  
14 can vary without obvious surveillance and it's in that  
15 context that we think that both the reporting of  
16 mishaps as well as focus away from the structural --  
17 in addition to the structural and on the chemical  
18 would be of importance.

19 Cement is not normally viewed as a, in a  
20 sense, leach resistant material. On the other hand,  
21 the whole question of waterproofing cement is an old  
22 issue and surface treatment of cement. If it weren't  
23 for the fact that the chemistry of cement is so  
24 complex, the whole issue would be fairly simple. I  
25 don't necessarily want to restrict comments on cement.

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1 There are, after all, other encapsulating materials  
2 that are perfectly satisfactory from a structural  
3 standpoint which also contain waste which we ought not  
4 to have easily leached out of those media.

5 COMMISSIONER ROGERS: Do you think there  
6 ought to be some kind of -- it sounds to me like  
7 there's -- I don't know anything about this area at  
8 all, but it does sound to me like there seems to be  
9 a weakness in some fundamental studies of what the  
10 ideal composition might be and how much variability  
11 you might permit in that. My impression is that when  
12 you make cement, you do it by the shovelful, not by  
13 the --

14 DOCTOR STEINDLER: Well, it isn't quite  
15 that bad. The material that's generally produced is  
16 subject to a significant amount of testing at this  
17 point in time for structural strength. That  
18 formulation is brought before the Commission staff in  
19 the form of a topic report analyzing both the  
20 formulation as well as the properties, and is approved  
21 or disapproved, depending on the kind of information.  
22 Once that formulation has been looked at and  
23 presumably approved, then adherence to that  
24 formulation even with some variations is not only  
25 expected but likely and hence the structural

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1 requirements are generally met.

2 There are probably as many formulations  
3 that are currently used as there are people using  
4 them. Whether they are substantially different is a  
5 moot point. They all seem to at the moment, if  
6 they're qualified, meet the current structural  
7 requirements. That's certainly possible.

8 COMMISSIONER ROGERS: Yes, but we're  
9 talking about the leachability question now.

10 DOCTOR STEINDLER: The leachability  
11 question, there's silence. That's an altogether  
12 different issue.

13 COMMISSIONER ROGERS: I wonder whether  
14 there really are any sound studies to guide one in  
15 this.

16 DOCTOR STEINDLER: Yes, I can't answer  
17 your question, but I think I would know who to go to  
18 and I think so does the staff. The staff is well  
19 aware.

20 CHAIRMAN CARR: Commissioner Remick?

21 COMMISSIONER REMICK: Just one follow-on  
22 question. How about the work that I just assume would  
23 have been done at a place like Savannah River and Oak  
24 Ridge where I guess they did what I would call  
25 hydrofracturing, injecting grouts with waste in the

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1 ground. Did they do any of this work on the  
2 leachability of --

3 DOCTOR STEINDLER: Mostly Oak Ridge, I  
4 think. I don't think Savannah River did too much of  
5 that. Yes. The leachability of that grout is in the  
6 literature. Its encapsulation is not quite the same  
7 as the encapsulation of ion exchange. That was not  
8 normally a slurry, although there were some slurries  
9 injected. A lot of that was solution material.

10 But I wouldn't want you to believe that  
11 there is no information out there. There is  
12 information out there and it's a question of simply  
13 collecting and relating it to the current waste forms  
14 that are being produced, for example at reactors.

15 COMMISSIONER ROGERS: Yes, but I guess my  
16 question was again the standards question. There's  
17 information, but then has it been incorporated into  
18 some generally accepted standards that people would  
19 follow or --

20 DOCTOR STEINDLER: There are structural  
21 standards -- there exist structural standards for  
22 cement. As far as I know, there are no chemically  
23 leachability standards for cement.

24 CHAIRMAN CARR: So I'll understand it, let  
25 me point the question a little more directly. I get

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1 the impression you think without the leachability  
2 limits that you don't think anybody can show the  
3 disposal facility to meet the general performance  
4 objective in Part 61?

5 DOCTOR STEINDLER: I'm not sure that I  
6 would put it in the context that they can't show. The  
7 issue is whether or not that's where the focus is.

8 CHAIRMAN CARR: Well, if they can show it,  
9 then would you say the leachability limits are  
10 probably not required?

11 DOCTOR STEINDLER: You need to have one  
12 or the other. I think again redundancy is an  
13 important issue.

14 CHAIRMAN CARR: Any other questions on  
15 this one?

16 Let's proceed.

17 DOCTOR MOELLER: The next item is the  
18 carbon-14 and that again will be Doctor Steindler.

19 DOCTOR STEINDLER: Okay. Let me again  
20 shift topics.

21 This is a working group product of the  
22 Advisory Committee. We held a meeting in October,  
23 late October on the question of carbon-14 as it  
24 relates to high-level waste disposal. We had  
25 previously talked about the whole question of gaseous

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1 releases from a repository and specifically carbon-14  
2 over the previous perhaps six months or so.

3 The working group met and had heard from  
4 a broad variety of folks, the EPA people, DOE, NRC  
5 staff and others. Let me back up a little bit.

6 It's a legitimate question to ask, who  
7 cares about carbon-14. After all, there's an awful  
8 lot of carbon-14 around. Why should somebody suddenly  
9 focus their attention on that little bit that came out  
10 of -- what now has been found to come out of fuel?

11 The last couple of years, if you look at  
12 the literature about gaseous releases from a  
13 repository, the interest in how do you meet various  
14 criteria and standards has picked up considerably as  
15 we get closer and closer to having to address the  
16 question in a forum such as a licensing hearing. Some  
17 conclusions have been reached by folks who have  
18 published papers that indicate that there is no way  
19 for a repository such as Yucca Mountain, that is one  
20 in which carbon-14 in the form of carbon dioxide can  
21 be released, could possibly meet the EPA regulations,  
22 or for that matter the NRC regulations. Well, those  
23 kind of papers immediately attract people's attention,  
24 as you might gather. That's point one.

25 Point two. As Dade has pointed out, we

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1 have been concerned that the EPA standard is too  
2 stringent. We immediately wondered whether or not  
3 this is certainly in the area where excessive  
4 stringency is going to lead to significant  
5 difficulties in an unnecessary sort of fashion.

6 Third item. It is only relatively lately,  
7 that is in the last five plus years perhaps, that the  
8 whole question of carbon-14 has been sufficiently  
9 clarified so we could identify how much carbon-14 is  
10 likely to be found in or on spent fuel and perhaps  
11 even what kind of form we might find it in and hence  
12 be able to try and estimate whether or not it's  
13 gaseous or solid or likely to be in solution.

14 So, we're looking at information which is  
15 perhaps five to seven years old. But in that period  
16 it's become fairly clear that there are two kinds of  
17 issues that people had to worry about. First off,  
18 because of the chemistry, again the chemistry, of  
19 reactors, between one and five percent of the total  
20 carbon-14 inventory is on the outside of the fuel, it  
21 is not on the inside at all. That carbon, in the form  
22 of crud on the outside of fuel elements, is subject  
23 to very rapid, relatively rapid, very rapid pulse  
24 release from a waste package if the canister is  
25 breached. That in itself becomes an important issue

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1 when release rates, as in the NRC regulations, are  
2 imposed on the system.

3 Furthermore, if you do the arithmetic, it  
4 turns out if you only release about ten percent of the  
5 total carbon 14 inventory, all other releases for all  
6 other nuclides must go to zero if you are to meet the  
7 EPA criteria. So, that's the framework within which  
8 problems arise.

9 There is an additional regulatory issue.  
10 The regulations, except for their modification when  
11 unsaturated systems became important, such as Yucca  
12 Mountain, regulations were written for saturated  
13 media. The basic background was that there would be  
14 liquid transport through water to the accessible  
15 environment. Gaseous transport, which tends to be  
16 significantly more rapid, especially in open systems  
17 like Yucca Mountain, were not really contemplated when  
18 the regulations were written. So, that's the scenario  
19 that we then find ourselves in.

20 Total inventory of a repository, to give  
21 you ballpark estimates, is likely to be somewhere  
22 between 70 and 100,000 curies of carbon-14. Carbon-  
23 14 has got a 5200 year half life and so it is  
24 sufficiently long so it begins to be a real nuisance  
25 in the context of the 10,000 year or even the 100,000

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1 year period that people begin to worry about.

2 Regulatory release limits run something  
3 in the neighborhood of a curie per year. That doesn't  
4 make any difference whether you're talking about one  
5 part in  $10^{-5}$  for the NRC or the total release inventory  
6 averaged over 10,000 years that the EPA puts together.

7  
8 Those two numbers then need to be compared  
9 to a number of other interesting numbers. The global  
10 production of cosmic ray carbon-14 is about 28,000  
11 curies per year.

12 CHAIRMAN CARR: Twenty thousand?

13 DOCTOR STEINDLER: Twenty-eight.

14 CHAIRMAN CARR: Twenty-eight.

15 DOCTOR STEINDLER: A number which I cannot  
16 personally verify, but you can easily pull out of the  
17 literature. So, we're looking at an annual carbon-14  
18 production rate which is approximately two and a half  
19 years worth will give you a repository.

20 The inventory, even if you are willing to  
21 neglect to some extent which we don't, but if you're  
22 willing to neglect the carbon-14s thrown into the  
23 atmosphere by weapons tests, the inventory and the  
24 global inventory at the moment is estimated to be  
25 about 230 million curies. That includes something

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1 like four million curies in the atmosphere and the  
2 rest are substantially in the oceans and in the biota  
3 and on the land. Four million curies in the  
4 atmosphere is, I think, a focus. We need to at least  
5 think about it.

6 So, the repository, 70,000 curie total  
7 inventory, the release limits that are currently  
8 existing at the one curie per year rate need to be  
9 somehow put in context of 28,000 curies per year  
10 production, 200 and some odd megacuries inventory,  
11 four megacuries in the atmosphere.

12 Then finally we need to at least mention  
13 the fact that if you estimate, and that's a real trick  
14 as I think Dade's discussion on the EPA standards has  
15 indicated to you, if you estimate the annual dose from  
16 the regulatorily allowed release from a repository,  
17 you end up at .05 microrem per year. .05 microrem per  
18 year is sufficiently below what I would term sensible  
19 numbers that it's hard to become extremely concerned  
20 about that kind of an issue. Yet on the other side  
21 of the context, these are the kind of numbers which  
22 cause potential difficulty in siting a repository.  
23 Therein lies, I think, the statement of the problem.

24 Allow me a couple other comments. The EPA  
25 Table 1, which is the famous cumulative table that

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1 we've been all talking about, allows 7,000 curies of  
2 carbon-14 to be discharged from a full 70 megaton  
3 repository, kiloton repository over a 10,000 year  
4 period. The NRC allows discharge rates at one part  
5 and  $10^{-5}$  per year, which is this one curie, about one  
6 curie, 7/10ths of a curie -- I don't draw a  
7 distinction -- neglecting any decay.

8 The issue, I think, in the case of carbon-  
9 14 were the non-uniformity that you mentioned before,  
10 Commissioner, of releases, is in fact a likelihood.  
11 I mentioned the pulse release because of the material  
12 that comes out on the outside. Further, if you look  
13 at the distribution of carbon-14 inside the fuel, if  
14 you breach the fuel pin, you find it's not uniformly  
15 distributed and is likely to come out over periods of  
16 time significantly shorter than some of the other  
17 fission products. So, you have certainly a nonuniform  
18 release.

19 The comparability of the EPA criteria and  
20 the NRC criteria is a little bit difficult but  
21 nonetheless we're still talking roughly about a curie,  
22 on the average of about a curie per year.

23 Well, those are some of the things that  
24 became reasonably clear in the course of our working  
25 group meeting. Let me see whether I can outline for

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1 you what we found. Let me jump, by the way, to the  
2 end.

3 I've posed a number of problems for you.  
4 I will not be able to provide for you the convenient  
5 solutions which I wish I could have. We are not done  
6 with the process. We are going to hear from others  
7 yet for a second try. I'm simply giving you a  
8 progress report and giving you an idea of where we  
9 think at least the problems are.

10 I mentioned that the regulations, both the  
11 NRC regulations and the EPA regulations, were written  
12 and formulated with saturated sites in mind. Water  
13 transport and geochemical barriers were supposed to  
14 be effective for the retardation of nuclides. That's  
15 not the case in the case of a gaseous release, at  
16 least not to a significant extent.

17 What does that do? That forces the entire  
18 burden for carbon control on the containment barrier.  
19 That's not defense in depth. It violates the whole  
20 issue of having more than one capability to retard  
21 material. It may well be that the stringency of the  
22 regulations are based on the fact that you've now lost  
23 effectively a couple of the barriers that you were  
24 counting on. It isn't very clear from the  
25 documentation that we have, which is not very

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1 complete, that that is a good excuse for the  
2 stringency of the regulation.

3 The one to five percent carbon-14  
4 inventory that resides outside of the cladding can  
5 very easily and is likely to violate the one part in  
6  $10^{-6}$  rule that the NRC has laid down, again based on  
7 aqueous transport.

8 EPA studies of their own regulations,  
9 they've recently completed two studies within this  
10 last year, indicated that on a reasonable basis the  
11 repository that they modeled would violate their own  
12 rules by about a factor of ten.

13 So, that's where we are. What have we  
14 done? We have probably not caused anymore confusion  
15 than already exists, which I think is a plus. We have  
16 by now a fairly complete record in the transcripts  
17 that we have taken for our meetings of what the  
18 situation is. We intend to talk to some other people  
19 about what their concerns are and then with luck we  
20 will try and see whether we can't provide some kind  
21 of sensible suggestions to you as to what we think  
22 might be done to alleviate the problem.

23 Let me just give you one other comparison  
24 and that is the one curie per year release, which is  
25 the equivalent to this .05 microrem, if you'll allow

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1 me, needs to be compared with some of the other  
2 regulations on dose that exist. I'm probably not  
3 stating anything that you don't already know. Power  
4 plants in 10 CFR 50 are at the five millirem per year.  
5 General facilities in 10 CFR 20 are approximately 100  
6 millirem per year. 40 CFR 61 allows for reactors in  
7 uranium mines ten millirem per year. A one gigawatt  
8 electric reactor currently fully operating for a year  
9 tosses out approximately ten curies per year. Compare  
10 that to the one curie from the repository. This is  
11 gigawatt reactor for every reactor.

12 So, it's in that context then that we look  
13 at this problem to try and determine, one, is there  
14 some sensible solution and should there be some  
15 specific exemptions that one might suggest, although  
16 those are hazardous things to start on if you do that.  
17 That's the status. All I can give you at this point  
18 is a kind of frame of reference in which we've looked  
19 at the carbon-14 issue. I'm sorry I can't provide you  
20 with a little more closure to the problem. I know  
21 that that's a thing of interest. It's a thing of  
22 interest to us too.

23 If we have some preliminary conclusions,  
24 I would say that we look at the EPA standard and we  
25 say, "Why, that's awfully tight. That doesn't add up

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1 in comparison to the rest of the exposure on carbon-  
2 14." We make the same statement about the general  
3 standards. Dade has just done that. But I'm focusing  
4 on carbon-14.

5 The population dose calculations that seem  
6 to be made don't agree at .05 microrem. This is the  
7 microrem for mega-people argument that just doesn't  
8 fly.

9 The NRC regulations also appear to be too  
10 stringent in this particular case.

11 I'd be happy to try and amplify.

12 CHAIRMAN CARR: Commissioner Remick?

13 COMMISSIONER REMICK: Two quick questions.  
14 A non-chemist's perspective is that carbon dioxide is  
15 readily soluble, or fairly readily soluble.

16 DOCTOR STEINDLER: Yes.

17 COMMISSIONER REMICK: Why would we think  
18 it would out in gaseous form? Is it because the  
19 proposed site is not as saturated as those --

20 DOCTOR STEINDLER: There's relatively  
21 little water, yes. They've done the analysis. It  
22 turns out that the path is such that you don't lose  
23 very -- you'd lose some, but you don't lose very much.

24 COMMISSIONER REMICK: Yes. And the other  
25 question, is there any reason to believe that the

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1 release of the one-fifth external to the cladding  
2 would be released anymore rapidly in the repository  
3 than it is in the spent fuel pool right now?

4 DOCTOR STEINDLER: Well, the pool is wet.  
5 That's perhaps the only difference and that's not a  
6 trivial difference.

7 COMMISSIONER REMICK: But if it's soluble  
8 in the water, the pool, it must be being removed  
9 with -- or is it being removed --

10 DOCTOR STEINDLER: Yes.

11 COMMISSIONER REMICK: -- through the  
12 filtration process? But it would a solid waste in  
13 that case, is that right?

14 DOCTOR STEINDLER: Right. Right.

15 COMMISSIONER REMICK: That's all, Mr.  
16 Chairman.

17 CHAIRMAN CARR: Commissioner Curtiss?

18 COMMISSIONER CURTISS: Just two quick  
19 questions. It's my impression that the staff here and  
20 at EPA acknowledge the problem, that the regulations  
21 were not initially drafted with an unsaturated zone  
22 in mind, first, and secondly that the subsequent work  
23 that's been done on carbon-14, which is new,  
24 relatively new, has pointed to a problem that  
25 everybody agrees needs to be addressed. I guess for

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1 that reason I think I'm fairly confident that the  
2 problem has an answer out there somewhere, whether  
3 it's an amendment of the EPA regs., as they've been  
4 fooling with them, or our regs. or both.

5 I guess the two questions that I have  
6 focus on the broader implications of the carbon-14  
7 issue. First, are there other examples either in the  
8 Table 1 values or in our regulations where this  
9 difference between the saturated and the unsaturated  
10 zone has the potential for posing the same kind of  
11 problem?

12 DOCTOR STEINDLER: If you look at the  
13 longer half life fission products and activation  
14 products, carbon is the only one that is readily  
15 volatilized. Obviously, krypton-85 is a gaseous  
16 material that's half life, however, is measured in ten  
17 year periods rather than 5,000 and as a consequence  
18 the substantially complete containment provision  
19 should cover that.

20 COMMISSIONER CURTISS: Okay. All right.  
21 Independent of the distinction between the saturated  
22 and the unsaturated zone, are there instances where  
23 focusing on the Table 1 values and comparable  
24 requirements in our regulations you have found that  
25 there are inconsistencies between what would be

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1 required?

2 DOCTOR STEINDLER: Yes.

3 COMMISSIONER CURTISS: Are there?

4 DOCTOR STEINDLER: Yes.

5 COMMISSIONER CURTISS: In particular Table  
6 1 areas or just in general terms?

7 DOCTOR STEINDLER: No, there are two or  
8 three, and Dade mentioned them, two or three areas  
9 where meeting the NRC regulation does not assure you  
10 that you're going to meet the EPA regulation. The  
11 distinction between those two is not tremendous. I  
12 don't think you're off by more than a factor of four  
13 in the worst instance. But it could easily stand  
14 corrected, so don't take that as gospel.

15 COMMISSIONER CURTISS: Okay.

16 DOCTOR STEINDLER: But that analysis has  
17 been done. It's been done by both the staff as well  
18 as the DOE folks.

19 Let me just add a comment. We're aware  
20 of the fact that EPA, NRC, the staff, are both looking  
21 at this question and that gives a little comfort to  
22 the requirement that we come up with a solution  
23 because other people will. I think DOE clearly is  
24 addressing this issue as well.

25 COMMISSIONER CURTISS: Okay.

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1                   CHAIRMAN CARR: I've got one. In the  
2 carbon-14 working group, the Committ. observed that  
3 WIPP may not be a good example of potential  
4 performance assessment problems for high-level waste  
5 repositories because WIPP will not be licensed under  
6 Part 60. Could you elaborate a little bit on that for  
7 us?

8                   DOCTOR STEINDLER: Well, I think the  
9 primary concern that one would raise is that  
10 redundancy in specific criteria, the three subsystem  
11 requirements that currently exist in the NRC licensing  
12 process, are not a requirement for the WIPP facility.  
13 As a consequence, it isn't very clear whether or not  
14 the WIPP facility would pass a licensing process if  
15 Part 60 were applied.

16                   CHAIRMAN CARR: But if the performance of  
17 the WIPP facility met the performance of -- assessment  
18 requirements of Part 60, would that make any  
19 difference?

20                   DOCTOR STEINDLER: No. No. This gets us  
21 into the question of what are the subsystem  
22 requirements good for. I'd be certainly happy to try  
23 and give you some views, but I'm not sure how much  
24 time you have.

25                   COMMISSIONER CURTISS: You'll miss your

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1 airplane, Mr. Chairman.

2 CHAIRMAN CARR: Any other questions on  
3 this subject? All right.

4 DOCTOR MOELLER: The next item is human  
5 intrusion and Bill Hinze will discuss that.

6 DOCTOR HINZE: Well, I'll briefly give you  
7 a status report on where we stand in terms of human  
8 intrusion. As with the carbon-14, we held a working  
9 group meeting in the latter part of October. As  
10 participants, we had the EPA, Sandia, the State of  
11 Nevada, the Bureau of Land Management, BLM, and the  
12 New Mexico Environmental Evaluation Board. We also  
13 had substantive statements from the staff of the NRC,  
14 the SAIC, the DOE contractor, as well as from the  
15 Center's staff.

16 The objective of our workshop was to  
17 attempt to gain a better understanding of the impacts  
18 of -- in human intrusion on a high-level waste  
19 repository, both from the standpoint of the  
20 inadvertent intrusion as well as intentional  
21 intrusion, and also to try to gain a viewpoint of what  
22 the associated problems are.

23 Now, there's been a great deal that has  
24 been written, discussed on this issue in both the  
25 national and international literature. So the

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1 question is why now and is this timely. Well, we  
2 believe that it was as a result of the remand of CFR  
3 191. There is the opportunity to suggest some changes  
4 in terms of some of the guidance that is provided  
5 regarding the human intrusion. So, this seems to be  
6 appropriate time.

7 In addition to that, in our March meeting  
8 of this year, we were told that the preliminary  
9 performance assessment at the WIPP site showed that  
10 the human intrusion seemed to be the major factor in  
11 the site not meeting the EPA requirements. By  
12 analogy, one could transmit that to other high-level  
13 waste repositories or perhaps the Yucca Mountain site.

14 But there are several important  
15 differences between WIPP and the Yucca Mountain site  
16 that have to be noted. WIPP is in a resource rich  
17 area in which there is a high likelihood that there  
18 may be inadvertent intrusion. The situation at Yucca  
19 Mountain is still not resolved. The site  
20 characterization studies have not been carried out to  
21 determine the natural resource assessment of the area.  
22 Furthermore, the area over which Yucca Mountain  
23 extends, the so called footprint, as it is called, is  
24 less in Yucca Mountain than it is at WIPP and also  
25 there is the integrity of the containers at the Yucca

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1 Mountain site.

2 Well, briefly, what were some of the  
3 results of our workshop? First of all, I thought that  
4 it was very encouraging that EPA has spoken in  
5 favorable tones concerning the possible modification  
6 of the Appendix B guidelines. The discussion at the  
7 workshop showed that the guidance in Appendix B  
8 regarding the average number of drill holes per unit  
9 area were open to a great deal of question and, in  
10 addition to that, the ceiling of the bore holes, which  
11 they give guidance on, is open to question.

12 Furthermore, the active control credit,  
13 which is limited to 100 years, certainly was under  
14 some discussion at the workshop as well as the credit  
15 for passive controls for the markers. The general  
16 feeling is that those were very stringent  
17 requirements.

18 We also heard about the three bucket  
19 approach to the operations of a high-level waste  
20 repository. We were very encouraged to hear that the  
21 staff is considering and has encouraged the removal  
22 of the human intrusion into the accidental operation  
23 and to be considered separately, as we have suggested  
24 in letters to you. We look forward to learning more  
25 about this and we understand that we will be learning

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1 more about this from the staff and what the EPA  
2 decides in terms of their approach to it. These  
3 procedures would lead to a preparation of CCDFs on the  
4 more likely scenarios and comparison then with the  
5 releases in Table 1.

6 We also learned from the BLM and others  
7 of the difficulty in defining the average number of  
8 drill holes. One of the things that was made very  
9 clear was that this average number that we were  
10 talking about an expert opinion also applies to the  
11 problem of the average number of drill holes, that  
12 this is very site specific.

13 Sandia explained to us that they were  
14 approaching their human intrusion problem by virtue  
15 of setting up four parallel, is our understanding of  
16 it, four parallel expert panels to investigate this  
17 issue. It is unclear to me, and that's my personal  
18 opinion, where they're getting the experts that have  
19 this knowledge about the sociological and  
20 technological considerations of millennia into the  
21 future.

22 Finally, the Committee and the  
23 participants, I think in a unanimous voice, stated  
24 their encouragement as to this type of means of  
25 communication with the staff, but also between the

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1 participants.

2           So, where do we go from here? Well, one  
3 of the obvious things is that we want to, and we think  
4 we should, monitor the Sandia expert panels as they  
5 proceed through, but taking in mind the difference  
6 between the defense site, the WIPP site and other  
7 sites. And as we have alluded to, we want to keep  
8 track and will be keeping track of the staff's  
9 approach to human intrusion and looking at radiation  
10 releases from the most probable scenarios.

11           In addition to that, as part of our  
12 ongoing concern about the potential adverse conditions  
13 at Yucca Mountain, we do want to continue to look at  
14 the site characterization activities and the NRC  
15 staff's guidance in this area because the first line  
16 of defense against at least inadvertent intrusion is  
17 to be removed from a site which is susceptible to  
18 natural resource intrusion.

19           That's about it.

20           CHAIRMAN CARR: Any questions?

21           COMMISSIONER REMICK: One. You indicate  
22 that for the WIPP site human intrusion is the dominant  
23 contributor to risk. But unless there's zero risk,  
24 isn't there always going to be a dominant contributor  
25 to that residual risk? The question becomes is the

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1 residual risk acceptable or not? Is there an  
2 inference here that the WIPP site might not be  
3 acceptable risk from a human intrusion standpoint?  
4 It's not clear to me what the meaning of those words  
5 are.

6 DOCTOR HINZE: Well, it's not my place,  
7 I think --

8 COMMISSIONER REMICK: I understand.

9 DOCTOR HINZE: -- to answer that question.  
10 It was of concern to Sandia and the WIPP investigators  
11 to find that this played such a prominent role in the  
12 performance assessment, essentially wiping out all of  
13 those other things that a great deal of work had been  
14 spent on. It really placed a certain burden on  
15 reconsidering some of the EPA guidelines. And  
16 particularly in that case, it's my recollection, is  
17 the sealing of the bore holes.

18 But we have to remember that they're in  
19 a resource-rich area with the petroleum fields, the  
20 salt deposits, et cetera. These are areas that you  
21 can develop scenarios for inadvertent intrusion pretty  
22 easily.

23 COMMISSIONER REMICK: But is the point  
24 you're making to us that human intrusion is very  
25 important and therefore should be carefully considered

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1 cr is it that one has to be very careful with the  
2 standards that are set so they're realistic? I'm not  
3 quite sure.

4 DOCTOR HINZE: Both. Absolutely both.  
5 Yes, sir.

6 COMMISSIONER REMICK: Thank you, Mr.  
7 Chairman.

8 CHAIRMAN CARR: Commissioner Curtiss?

9 COMMISSIONER CURTISS: Just one question.  
10 I guess in considering what you've said and in looking  
11 at the human intrusion issue, this issue strikes me  
12 as one that in terms of our ability to postulate the  
13 human intrusion scenarios strikes me as one that's  
14 very much akin to the sabotage issue at nuclear power  
15 plants. That is to say we haven't been able to  
16 quantify the sabotage question and for that reason  
17 historically have treated that issue in a different  
18 manner where we have eschewed reliance on quantitative  
19 evaluation in favor of what is necessarily a much more  
20 subjective approach to the sabotage issue.

21 The question, recognizing that the so-  
22 called three bucket approach is, I guess, in its  
23 preliminary stage of discussion, do you see this issue  
24 as one, from what you know, that is akin to the  
25 sabotage question? And if so, is the three bucket

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1 approach something that would comport with the way  
2 we've roughly treated sabotage?

3 DOCTOR HINZE: Let me add to that the best  
4 I can. Doctor Moeller has consistently brought up the  
5 analogy that you've just specified and we've discussed  
6 that at some length. I personally think that we do  
7 need to consider this in as much of a deterministic  
8 way as possible and then move to the expert judgement  
9 and see how that really is moving. Are we really  
10 getting good information out of that?

11 For example, the natural resource  
12 assessment at Yucca Mountain can play a very important  
13 role in terms of this. I don't think we just need to  
14 handle this completely separately. I think the staff  
15 is on the right track in terms of their development  
16 of scenarios. I want to learn more in terms of the  
17 criteria that they use for prioritizing those  
18 scenarios, and part of that will be -- we hope that  
19 we will get some input from these expert judgment  
20 workshops that will help us to evaluate this better.

21 I don't know that I've answered your  
22 question, but I don't think we should answer that  
23 question right now. I don't think we should place it  
24 in the sabotage area at this point.

25 COMMISSIONER CURTISS: Looks to me like

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1 you think things are on the right track right now,  
2 though.

3 DOCTOR HINZE: That's right.

4 COMMISSIONER CURTISS: Okay. That's all  
5 I have.

6 CHAIRMAN CARR: Commissioner Rogers?

7 COMMISSIONER ROGERS: No questions.

8 CHAIRMAN CARR: All right. Let's proceed.

9 DOCTOR MOELLER: The next item is mixed  
10 waste and in view of the hour I will keep it brief.

11 Let me say that in response to  
12 Commissioner Curtiss' request we held a working group.  
13 Well, we've been looking at the subject of mixed  
14 waste. We held a working group meeting on Tuesday of  
15 this week, December the 11th, and we had appearing at  
16 that working group members of the NRC staff, but we  
17 also heard from people who are knowledgeable about the  
18 efforts in California, in Nebraska and in Illinois in  
19 terms of the low-level waste facilities that are in  
20 the design stage for those various compacts. We also  
21 heard from people from DOE who were present at the  
22 meeting.

23 We are not in a position or we have not  
24 reached conclusions on the matter. We hope to be --  
25 well, we are drafting a report and we hope to get it

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1 out at our next meeting in January. Let me say,  
2 though, the following just to share with you some of  
3 the things we learned.

4 In terms of the facility in Illinois, for  
5 example, where there -- and in Nebraska both of  
6 these, where due to public pressure they are designing  
7 in essence what could be comparable to the bunkered  
8 concrete systems for intermediate waste, intermediate-  
9 level waste, that are used in France. In view of the  
10 fact that they've moved that way and all of these are  
11 above-ground facilities, it becomes relatively easy  
12 to incorporate into those facilities components or  
13 separate units that will handle mixed waste and will  
14 indeed comply. It appears that they will comply with  
15 both the NRC regulations and EPA's RCRA regulations.  
16 Now, in neither case, in none of these cases has  
17 anyone yet applied for a RCRA permit and so forth, but  
18 it does appear that that will be the case and that,  
19 indeed, they will be able to comply.

20 We had two top level representatives, I  
21 should have said, from EPA at our workshop and one  
22 thing we learned is RCRA is complicated as can be and  
23 EPA is far more complicated than the NRC.

24 CHAIRMAN CARR: Any questions?

25 COMMISSIONER CURTISS I just have one

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1 comment, I guess. My interest in this matter and the  
2 question that I've asked you to address, which is can  
3 we say that for mixed waste either Part 61 or RCRA  
4 Subtitle C requirements alone is sufficient to address  
5 whatever health and safety concern exists, that  
6 question derives from a concern that the approach that  
7 we've outlined in the joint guidance, while it may be  
8 theoretically possible to achieve, may prove to be  
9 practically difficult and, if possible, very  
10 expensive. In fact, that's what I think the Nebraska  
11 and the California people are discovering. California  
12 has decided not to go ahead. Nebraska estimates that  
13 it's \$10,000.00 per cubic foot to design a facility  
14 in that manner.

15 I'd like to see your conclusions as early  
16 as I can on this question of whether the one set of  
17 requirements or the other can get the job done and  
18 then one agency or the other can step back, hopefully,  
19 from the jurisdictional question that we focused on  
20 for so many years and simply say, "Your regulations  
21 address our concerns. Have at it."

22 I must say that just recently I have been  
23 pleased to see the reports that are beginning to come  
24 out that as another possible solution to this problem  
25 the Department of Energy is taking a look at accepting

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1 mixed waste and that would moot a number of the  
2 options that we've considered over the years,  
3 including the joint guidance question, if they would  
4 add this very small, but what turns out to be very  
5 expensive to dispose of, component from the commercial  
6 side to their ledger and get on with addressing it in  
7 their context consistent with the RCRA requirements  
8 that will be imposed on them.

9 So, I look forward to what you have to  
10 say, but as a note I did want to put in a positive  
11 commendation for whatever efforts are underway to  
12 pursue the option of DOE taking the commercial mixed  
13 waste.

14 CHAIRMAN CARR: I'm also encouraged about  
15 the approach that people are taking to the treatment  
16 of mixed waste --

17 COMMISSIONER CURTISS: Very much so.

18 CHAIRMAN CARR: -- as a mixture, so that's  
19 encouraging too.

20 Let's proceed.

21 DOCTOR MOELLER: Well, the last item is  
22 the potential working group meetings and Paul Pomeroy  
23 will review those.

24 DOCTOR POMEROY: In the interest of time,  
25 I'd like to simply list the subjects that we are going

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1 to consider in working groups and make a few comments  
2 at the end, and then the members of the Committee will  
3 be happy to address in greater detail any of the  
4 specific issues.

5 The issues that we are going to address  
6 in working groups are, first, the proper role of  
7 expert judgment in the site characterization and  
8 licensing process, and that working group meeting is  
9 going to take place on the 25th of January.

10 The second subject is computing collective  
11 doses from ionizing radiation, and that's going to  
12 take place on February 19th, 1991.

13 The following working groups do not have  
14 specific dates, but the working group subjects are  
15 geologic dating; volcanism, which I'd like to return  
16 to very briefly at the end if I may; long-term climate  
17 change; seismic hazard; a working group on the white  
18 paper on the geophysical aspects of the repository,  
19 SCP, and I apologize for the length of that subject.  
20 The man to my right is responsible for that.

21 We also anticipate, as you've heard,  
22 scheduling second working group meetings on one or  
23 more of these issues in -- and probably all of these  
24 are going to take place in the next six months.

25 I think you can recognize the value of the

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1 working groups. You've heard the reports from some  
2 the first working groups. There are -- to  
3 accomplish our mission, the working groups need to be  
4 timely, as Doctor Hinze pointed out. They need to  
5 have a wide range of participation, and the ACNW is  
6 perceived -- correctly, I believe -- to be both  
7 independent and neutral in this regard and perhaps  
8 unique in that respect, and as a result we are able  
9 to achieve, to have all of the potential participants  
10 take part in our working groups. We need, of course,  
11 to be able to elicit the information that we need in  
12 a working group format.

13 And finally, our format itself has been  
14 extremely successful and I'd like to stress that.  
15 It's a very informal atmosphere and there is a very  
16 free exchange of information.

17 We currently feel that there is a need for  
18 an update of the one particular subject that I  
19 mentioned I'd come back to -- that is, volcanism. The  
20 Nuclear Waste Technical Review Board is also  
21 interested in having an update on that same issue and  
22 we are currently initiating investigations, if you  
23 will, on the mechanism whereby we can meet jointly to  
24 extract the information in the most efficient way  
25 possible for the purposes to satisfy the mission of

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1 both groups.

2 I think I'll stop there, in view of the  
3 time. Thank you.

4 CHAIRMAN CARR: Questions?

5 COMMISSIONER REMICK: I trust on the one  
6 on computing collective doses you'll home in on this  
7 question of whether it's proper to truncate doses or  
8 whether one should integrate over the universe. I  
9 hope that you --

10 DOCTOR MOELLER: Yes, sir.

11 COMMISSIONER REMICK: -- explore that.

12 COMMISSIONER CURTISS: Just an  
13 observation. It's my impression that this new working  
14 group format has been a very productive one, very  
15 disciplined and well-focused and organized and from  
16 both the perspective of the staff and the outside  
17 participants I've heard good things about it, so I  
18 encourage you to keep up that work.

19 DOCTOR POMEROY: Thank you.

20 CHAIRMAN CARR: Commissioner Rogers?

21 COMMISSIONER ROGERS: Well, just to add  
22 to that, I've heard the same thing and I want to  
23 commend you on really taking this approach that seems  
24 to be a very useful one.

25 Just a little cautionary note about

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1 reports, while it's very important for us to get  
2 reports from you we want them when you feel they're  
3 ready and not before.

4 DOCTOR MOELLER: Thank you.

5 DOCTOR HINZE: Thank you.

6 CHAIRMAN CARR: Any other comments?

7 COMMISSIONER REMICK: Just a general  
8 comment. I found the meeting very, very informative  
9 and useful.

10 And then, a personal note from one  
11 Commissioner. I detect that you are focusing a large  
12 part of your effort in the high-level waste area and  
13 I think that's important. That's where I feel I need  
14 your help, particularly in the ologies associated with  
15 a repository and perhaps somewhat lesser extent to the  
16 low-level waste, but that's important also. But, I  
17 encourage you to utilize your limited time and  
18 resources in helping us, helping me in those areas.  
19 That's where I really look to you for help and I  
20 appreciate it.

21 CHAIRMAN CARR: Well, I would like to  
22 thank Doctor Moeller, Doctor Steindler, Doctor Hinze,  
23 and Doctor pomeroy for providing the Commission with  
24 this update and discussion about the Committee's  
25 activities. These periodic discussions are helpful

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1 for the Commission, exploring the views of the  
2 Committee on the important technical issues associated  
3 with high-level and low-level radioactive waste  
4 management.

5 I'm encouraged by your recent shift in  
6 focus to specific technical issues that the Committee  
7 deems important. Initial experience with the working  
8 group concept suggests that this forum will be  
9 effective in promoting informal communication among  
10 experts on important technical issues. I caution you  
11 to work closely with the NRC staff who have  
12 responsibility for resolving these complex issues.

13 I also encourage you to pursue your plans  
14 for coordinating workshops on priority technical  
15 issues with external agencies such as the Nuclear  
16 Waste Technical Review Board to enhance the  
17 effectiveness and efficiency of the independent review  
18 process. We look forward to reviewing your  
19 recommendations from the working groups as well as the  
20 other committee reviews.

21 Do my fellow Commissioners have any  
22 additional comments? If not, we stand adjourned.  
23 Thank you very much.

24 (Whereupon, at 10:06 a.m., the above-  
25 entitled matter was adjourned.)

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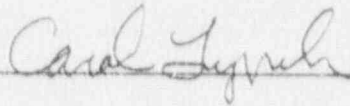
This is to certify that the attached events of a meeting  
of the United States Nuclear Regulatory Commission entitled:

TITLE OF MEETING: PERIODIC MEETING WITH ADVISORY COMMITTEE  
ON NUCLEAR WASTE

PLACE OF MEETING: ROCKVILLE, MARYLAND

DATE OF MEETING: DECEMBER 13, 1990

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.

  
\_\_\_\_\_

Reporter's name: Peter Lynch



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

December 5, 1990

MEMORANDUM FOR: Samuel J. Chilk, Secretary of the  
Commission  
FROM: *Raymond F. Fraley*  
Raymond F. Fraley, Executive Director  
ACNW  
SUBJECT: ACNW MEETING WITH NRC COMMISSIONERS  
DECEMBER 13, 1990

Attached for the information and use of the Commissioners is a package of background material for the topics to be discussed on December 13, 1990.

Members of the Committee will be prepared to provide a brief statement of Committee position on each item and any anticipated/planned future activities.

Attachments:  
As stated

cc: ACNW Members  
M. Federline, OCM/KC  
M. Weber, OCM/KC  
S. Bilhorn, OCM/KR  
J. Kotra, OCM/JC  
R. Boyle, OCM/FR  
J. Taylor, EDO  
E. Beckjord, RES  
R. Bernero, NMSS  
M. Taylor, EDO



BACKGROUND ACNW LETTERS/REPORTS FOR THE ITEMS  
TO BE DISCUSSED AT THE PERIODIC MEETING  
WITH THE COMMISSIONERS  
DECEMBER 13, 1990 - 8:30 A.M.

The following is the list of agenda items for the December 13, 1990 meeting between the ACNW and the NRC Commissioners in order of their priority, along with the ACNW issued Reports/Letters written for each of the items:

Table of Contents

Items to be Discussed:

- A. EPA's HLW Standards - Item A, Pages 1 to 22  
-- (D. Moeller)
  
- B. Draft Waste Form Technical Position - Item B, Pages 1 to 5  
-- (M. Steindler)
  
- C. Status Report on Working Groups - Item C
  - 1. C-14 Transport -- (M. Steindler) Pages 1 to 3
  - 2. Human Intrusion -- (W. Hinze) Pages 4 to 5
  - 3. Mixed Waste -- (D. Moeller) Pages 6 to 9
  - 4. Potential Working Group Meetings -- (P. Pomeroy) Page 10

ITEM A

EPA'S HLW STANDARDS

ADVISORY COMMITTEE ON NUCLEAR WASTE MEETING  
WITH COMMISSIONERS  
DECEMBER 13, 1990

Carbon-14 Transport

Table of Contents

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1. Table of Contents	1
2. Working Group on Carbon-14, October 26, 1990, Meeting Agenda	2-3

BACKGROUND:

For several months the Committee has been concerned that the release of radioactive gases from the repository could result in exceeding regulatory limits. This problem exacerbated when it was postulated that radioactive gases could generate excessive pressures in the buried containers which could result in a breach of their integrity. This breach could result in eventual release of radionuclides to man's environment.

The Committee convened a Working Group on Carbon-14 which met on October 26, 1990. The agenda is attached. Presentations addressed the most recent EPA contractor report on C-14, the nature and generation of Carbon-14, its chemical forms, anticipated transport times from container breach to their atmosphere, resultant exposure estimates and other relevant technical facts. The last formal presentation was an analysis which stated that the applicable repository regulations were overly conservative.

As of this writing, the Committee as a whole has not yet approved a consensus position.

Cognizant ACNW Member:  
Cognizant ACNW Staff:

M. J. Steindler  
H. J. Larson

26th ACNW Meeting  
December 12-13, 1990

The Committee's views were also presented to the National Academy of Science/National Research Council Symposium on September 17, 1990. A copy of that presentation is attached.

The Committee continues to maintain dialogue on this topic with both the NRC and EPA staffs and has had DOE representation and/or participation at all applicable meetings. In response to his questions, the Committee responded on October 10, 1990, to R. J. Guimond, Director, Office of Radiation Programs, EPA and offered to meet and discuss in detail matters related to the EPA HLW standards. A copy of that letter is also attached.

Cognizant ACNW Member: D. W. Moeller  
Cognizant ACNW Staff Member: H. J. Larson



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

May 1, 1990

The Honorable Kenneth M. Carr  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Dear Chairman Carr:

SUBJECT: CRITIQUE OF THE ENVIRONMENTAL PROTECTION AGENCY'S  
STANDARDS FOR DISPOSAL OF HIGH-LEVEL WASTES

In response to your request during our meeting on February 21, 1990, the Advisory Committee on Nuclear Waste offers the following comments on the problems we see with the EPA standards (Ref. 1) for the disposal of high-level wastes. These comments are an outgrowth of our ongoing review of these standards, including a full-day session on this matter during our 18th meeting, March 22-23, 1990, and additional discussions during our 19th meeting, April 26-27, 1990. Organizations whose representatives took part in the discussions during our 18th meeting included the Environmental Protection Agency, the Nuclear Waste Technical Review Board, the staff of the Board on Radioactive Waste Management of the National Academy of Sciences, the Environmental Evaluation Group of the State of New Mexico, the Advisory Committee on Nuclear Facility Safety of the U.S. Department of Energy, and the General Accounting Office. Members of the NRC staff also attended these meetings.

Key technical problems with the EPA standards include the following:

1. All such standards should be organized in a hierarchical structure with the higher levels expressing the objectives in a qualitative sense and the lower levels stating the objectives quantitatively. Of utmost importance is that the several levels be consistent and that lower levels not be more stringent or conservative than the higher levels, so that they become de facto new standards. This is not the case with the EPA standards.

2. Although lower level standards can be stated probabilistically, they should be expressed in terms of annual risk limits from a disposal facility in an undisturbed and a disturbed state. The critical population group being considered should be clearly defined. This approach is in accord with recommendations of organizations such as the International Commission on Radiological Protection and the United Kingdom's National Radiological Protection Board.
3. The standards should apply to the disposal facility as a system. Subsystem standards, if expressed, should be given only as guidance, with qualifying statements clearly specifying that they are not to be applied in a regulatory sense.
4. Evaluations of the anticipated performance of the proposed Waste Isolation Pilot Plant indicate that, for the disturbed state, human intrusion is the dominant contributor to risk. Early indications suggested that performance analyses for the proposed Yucca Mountain repository may also show human intrusion to be important. This appears to be a direct result of how the standards for evaluating such intrusions are interpreted, compounded by the overly conservative requirements of the standards. To ameliorate this issue, we suggest that the standards be rewritten to separate the evaluations of anticipated performance into three parts: (a) the undisturbed repository; (b) the disturbed repository, exclusive of human intrusion; and (c) the repository as it might be affected by human intrusion. This would clearly separate out the problem of human intrusion and permit it to be addressed directly. In this regard, we join with the Advisory Committee on Nuclear Facility Safety, U.S. Department of Energy, in recommending that EPA's standards be reworded to permit "considerations such as expectations for future borehole sealing at least as good as the current state-of-the-art." We also believe that more realistic assessments should be made of the potential impacts of human intrusions and that greater credit should be allocated to the ability of future generations to be aware of the presence of a geologic repository through identifying markers and associated records.
5. Experience has shown that probabilistic risk analyses cannot be used reliably to determine the compliance of a single nuclear power plant with a set of standards. A high-level waste repository, which must function for 10,000 years, is still more difficult to assess quantitatively. The EPA standards should clearly specify that risk assessments are but one of several inputs into the evaluation of a given high-level waste repository site and/or facility. Such assessments should not be the only factor in evaluating compliance of such a facility with the EPA standards.

May 1, 1990

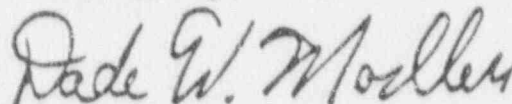
In summary, our key recommendations are:

1. The existing EPA standards need to be revised; now is the time to accomplish this task;
2. The standards should be revised to define what is considered to be an acceptable risk from a high-level waste repository;
3. The standards should specify that a probabilistic approach is acceptable so long as it is but one of several factors to be used in determining the acceptability of a specific site; and
4. The standards should be revised to include separate considerations for evaluating the impacts of human intrusion.

We stand ready to join you and the NRC staff in working with EPA to help develop an acceptable set of standards for a high-level radioactive waste repository. We believe this is the best course of action at the present time. If, however, after a reasonable period of time these efforts do not appear to be accomplishing our mutual goals, we believe other approaches should be considered. One would be for you, as Chairman of the NRC (perhaps joining with the Secretary of DOE) to approach the EPA Administrator with a suggestion that an appropriate organization be selected to review the standards and make recommendations for change. Suggestions for two such organizations are the National Academy of Sciences and the Council on Environmental Quality.

We hope that these comments are helpful. We will be pleased to discuss these matters with you at your convenience.

Sincerely,



Dade W. Moeller  
Chairman

References:

1. U.S. Environmental Protection Agency, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," (40 CFR Part 191), Working Draft 2, dated January 31, 1990

May 1, 1990

2. Letter dated April 17, 1990 from F. L. Galpin, Environmental Protection Agency to Dade W. Moeller
3. Letter dated December 11, 1989 from John F. Ahearne, Advisory Committee on Nuclear Facility Safety, DOE, to James D. Watkins, Secretary of Energy, DOE
4. Sandia National Laboratories, SAND89-2027, "Performance Assessment Methodology Demonstration: Methodology Development for Evaluating Compliance With EPA 40 CFR 191, Subpart B, for the Waste Isolation Pilot Plant," Printed December 1989
5. International Commission on Radiological Protection, ICRP Publication 46, "Radiation Protection Principles for the Disposal of Solid Radioactive Waste," published for the International Commission on Radiological Protection by Pergamon Press, Oxford, England, July 1985
6. National Radiological Protection Board, NRPB-GS 1, "Radiological Protection Objectives for the Disposal of Solid Radioactive Wastes," published in Oxfordshire, England, 1983





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

June 1, 1990

The Honorable Kenneth M. Carr  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Dear Chairman Carr:

SUBJECT: REVIEW OF NRC STAFF COMMENTS ON WORKING DRAFT NO. 2 OF  
EPA'S HIGH-LEVEL WASTE DISPOSAL STANDARDS

In response to your request, the Advisory Committee on Nuclear Waste reviewed the above subject report (SECY-90-162) during its 20th meeting, May 24-25, 1990. Our comments follow.

Overall, we believe that the comments and recommendations of the NRC staff are thorough and comprehensive. If implemented by EPA, these suggestions would represent an important step toward resolving many of the problems cited by this Committee. The comments by the NRC staff are in general agreement with the remarks submitted to you in our letter of May 1, 1990. However, we offer the following clarifications on several key points:

1. One of our criticisms of the EPA Standards was that they should be organized using a hierarchical structure and that lower levels should not be more stringent or conservative than higher levels. The call (Comment 2.1) by the NRC staff for EPA to conduct performance assessments of real sites (which will undoubtedly prove to be more complex than the hypothetical sites evaluated to date), and (Comment 1) to "explicitly document the acceptable risk level that underlies the release limits in the standards" should provide the information necessary to resolve this criticism.
2. We also urged that EPA express its lower level standards in terms of annual risk limits and that the critical population group be defined. We wish to reiterate this recommendation since this is standard practice in evaluations of public exposures from all types of environmental radionuclide releases. When combined with limits on cumulative releases, this approach assures control of both individual and collective doses.

June 1, 1990

3. Our recommendation that subsystem standards be used only as guidance was directed primarily to the limits within the EPA Standards on doses to members of the public arising through consumption of contaminated groundwater. This recommendation applies equally, however, to the 1,000 year groundwater travel time in 10 CFR Part 60. If, for example, waste containers that have a projected lifetime of 10,000 years could be developed, a more relaxed groundwater travel time might be acceptable.
4. Because of its major contribution to risk, we recommended that the EPA Standards be revised to include separate considerations for evaluating the impacts of human intrusion. The approaches suggested by the NRC staff (Comments 5 and 18) are fully compatible with our recommendations.

In addition, the steps recommended by the NRC staff will help resolve some of our basic concerns relative to the potential difficulties that might be encountered in attempting to confirm compliance of a proposed HLW repository facility with the probabilistic requirements of the EPA Standards.

In summary, we believe that the comments and suggestions of the NRC staff are in concert with our recommendations. If implemented, these suggestions would resolve our major concerns.

Sincerely,

*Dade W. Moeller*

Dade W. Moeller  
Chairman

Reference:

SECY-90-162, May 7, 1990, "Comments on Working Draft No. 2 of the U.S. Environmental Protection Agency's High-Level Waste Disposal Standards" (Predecisional)



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

August 3, 1990

Mr. Robert M. Bernero, Director  
Office of Nuclear Material Safety  
and Safeguards  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Dear Mr. Bernero:

SUBJECT: NRC STAFF'S APPROACH FOR DEALING WITH UNCERTAINTIES IN  
IMPLEMENTING THE EPA HLW STANDARD

During the 22nd meeting of the Advisory Committee on Nuclear Waste, July 30-31, 1990, we met with the NRC staff to review and comment on the subject draft SICY paper (Reference 1). This draft was prepared by the staff in response to a request by the Commission for a "... summary on the staff's current approach to dealing with uncertainties/methodologies in implementing the EPA probabilistic standard so as to avoid [as] many of the controversial aspects as possible."

We believe, for the reasons given below, that the staff's approach is not adequate. We include in this letter specific comments on the draft paper and also provide our comments on other aspects of the staff's role in implementing the EPA Standards.

1. The draft paper describes two parts to the finding of compliance with the EPA Standards. One part deals with the standard of performance and the other with confidence that the standard of performance has been met. The staff has failed, however, to provide an adequate approach for dealing with residual uncertainties that will be encountered in completing this finding. Much of the paper concerns methods for reducing and managing uncertainties related to 10 CFR Part 60 and the potential activities of DOE, but the staff appears to have neglected to develop an adequate approach for dealing with uncertainties inherent in 40 CFR Part 191.
2. The paper acknowledges, albeit in conditional terms, the need for expert judgment, but provides no insight on how the staff will apply this judgment or develop an approach for selecting from among conflicting but apparently equally supported opinions. We believe that expert judgment will be required

August 3, 1990

Regardless of the specific form of the final EPA Standards, and thus, the approach to the use of expert judgment in a robust manner is crucial to the quality of the licensing determinations.

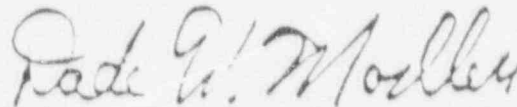
The transcript of the 22nd AONW meeting contains the details of our discussion with the staff concerning conflicting expert opinions. Our conclusion is that it may not be appropriate to treat discrepancies in expert opinions by using weighted averages unless this process has been carefully analyzed and the limitations of its application to both technology and licensing matters are well defined.

3. The staff has included strategies in the paper such as rulemakings to 10 CFR Part 60 to reduce uncertainties. While it is possible to narrow the technical and regulatory topics so that only fully determinable variables remain to be considered in the licensing process, we believe this tactic is neither likely to be successful nor is it appropriate. The description offered by the staff does not allow insight into the scope or the schedule that the staff strategy would call for, in part because existing rulemaking topics are not in an advanced stage of development. The status and description of rulemaking previously proposed to support the conclusion that the EPA Standards are workable are cast into question as is the ability to bring uncertainties into concert with the use of the H/W probabilistic standards.
4. We were unable to discern the relationship between the draft paper and the content of the related strategy document prepared by the NRC staff (Reference 2). We concluded that an integrated overall strategy and a strategy for devising methods for demonstrating compliance with the EPA Standards are necessary and we urge the staff to develop such an integrated approach for delineation of methods that would demonstrate such compliance. Such an integrated strategy should also address the connection between those activities to be carried out by DOE in response to uncertainties related to 10 CFR Part 60 and the NRC staff activities related to demonstration, by DOE, of compliance with 40 CFR Part 191.
5. The current reevaluation of the EPA Standards, which may include a reformulation of its probabilistic requirements, mandates a reexamination of assumptions about its implementability that were made a number of years ago. This requires prompt attention to the development of a coherent strategy for dealing with the various uncertainties that arise in performance assessment. The staff should be urged to undertake such a development without delay.

August 3, 1990

We conclude that the draft paper should be modified by the staff to include a coherent strategy outline that explicitly addresses the implementation of the EPA Standards and consideration of the associated uncertainties. The modifications should include exposition of the bases on which the strategies are developed, their application to regulatory and technical uncertainties, and a more deliberate discussion of how expert judgment would be applied, evaluated and justified.

Sincerely,



Dale W. Moeller  
Chairman

References:

1. Staff's Approach for Dealing With Uncertainties in Implementing the EPA HLW Standards (WITS 8900236), draft SECY paper, undated.
2. SECY-90-207, First Update of the Regulatory Strategy and Schedules for the High-Level Waste Repository Program, dated June 7, 1990.

cc: M. Federline, OCM/EC  
M. Weber, OCM/EC  
S. Bilhorn, OCM/FR  
J. Kotra, OCM/JC  
K. Dragoshette, OCM/JC  
K. MacDougall, OCM/FR  
H. Thompson, EDO  
R. Browning, NMSS  
A. Eiss, NMSS  
D. Fehring, NMSS

COMMENTS OF THE ADVISORY COMMITTEE ON NUCLEAR WASTE  
OF THE U.S. NUCLEAR REGULATORY COMMISSION

General Introduction

In June 1988, the U.S. Nuclear Regulatory Commission established the Advisory Committee on Nuclear Waste (ACNW). The Committee reports to and advises the Nuclear Regulatory Commission (NRC) on aspects of nuclear waste management within the purview of NRC's regulatory responsibilities. The focus of the Committee's work is largely on disposal but also includes other aspects such as handling, processing, transportation, storage, and safeguarding of nuclear wastes including spent fuel, nuclear wastes mixed with other hazardous substances, and uranium mill tailings. In performing its work, the Committee examines and reports on specific areas of concern referred to it by the Commission. The Committee is authorized to undertake other studies and activities on its own initiative related to those issues directed by the Commission.

In its first two years of existence, the Committee held 21 general meetings and several working group sessions and issued 37 letter reports. In addition, the Committee routinely met with the Nuclear Regulatory Commission to discuss items of mutual interest and concern.

Currently, the Committee is authorized a maximum of four members. Members are appointed by the Nuclear Regulatory Commission.

The ACNW traces its history back to the Advisory Committee on Reactor Safeguards (ACRS). The first Chairman and Vice-Chairman of the ACNW (Drs. Moeller and Steindler, respectively) had served on the ACRS where they participated extensively in the waste management reviews by the ACRS. They now continue this function with the ACNW. The current members of the ACNW are:

ACNW MEMBERSHIP

CHAIRMAN: Dr. Dade W. Moeller, Professor of Engineering in Environmental Health, School of Public Health, Harvard University, Boston, Massachusetts

VICE-CHAIRMAN: Dr. Martin J. Steindler, Director, Chemical Technology Division, Argonne National Laboratory, Argonne, Illinois

## MEMBERS:

Dr. William J. Hinze, Professor, Department  
of Earth and Atmospheric Sciences,  
Purdue University, West Lafayette, Indiana

Dr. Paul W. Pomeroy, President, Rondout  
Associates, Incorporated, Stone Ridge, New York

Today, we will be providing a summary of the advice given to the Nuclear Regulatory Commission on EPA's proposed high-level waste standards and ACNW comments on the NRC staff's review of the DOE Site Characterization Plan (SCP) for the proposed high-level waste repository at Yucca Mountain, Nevada.

### EPA STANDARDS

For more than five years the ACNW and its predecessor organization have been concerned that the current set of proposed EPA standards is overly stringent, is wasteful of resources, and cannot be implemented. These concerns are based on extensive meetings and discussions with a wide range of organizations, including relevant Federal and State agencies as well as industrial and private groups. One of the highlights of these interactions was a meeting held at the Committee's conference room in Bethesda, Maryland, on March 23, 1990. The Committee continues to doubt that compliance with the EPA standards can be demonstrated for a specific repository site, even with reasonable application of the caveats included in the currently proposed standard, such as the "reasonable assurance" phrase that allows for certain flexibilities in the interpretation of probabilistic analyses. Regardless of the schemes proposed to resolve uncertainties in applying probabilistic techniques (e.g., rulemaking), the Committee has seen no convincing evidence that the current set of standards will prove to be workable.

The ACNW has concluded that the EPA standards need to be revised and that now is the time to accomplish this task. The Committee has even suggested several organizations whose recommendations for change should be sought, including the National Academy of Sciences. In such a revision, the Committee recommended that the standards should be organized in a hierarchical structure with the higher levels expressing the objectives in a qualitative sense and the lower levels stating the objectives quantitatively. The Committee stressed that the several levels be consistent and that lower levels not be more stringent or conservative than the higher levels so that they become *de facto* new standards. The Committee believes that the proposed quantitative EPA standards may be internally inconsistent. In addition, we believe that secondary requirements, if expressed in the EPA standards, should be given only as guidance, with qualifying statements clearly specifying that they are not to be applied in a regulatory sense.

Three principal Committee recommendations for revising the EPA standards are:

1. An acceptable risk from a high-level waste repository should be defined and justified, keeping in mind the benefits derived from the activity involved, and other societal risks as well as additional relevant considerations. Lower-level standards should be expressed in terms of annual risk limits from a disposal facility in an undisturbed and a disturbed state. The critical population group being considered should be clearly defined. This approach is in accord with recommendations of organizations such as the International Commission on Radiological Protection and the United Kingdom's National Radiological Protection Board.
2. It should be specified that inclusion in the standards of an appropriate probabilistic approach is acceptable to the definition of risk from a repository, only if it is clearly noted that this probabilistic approach is not the single determining factor in judging the acceptability of a specific site. Experience has shown that probabilistic risk analyses (PRAs) alone cannot be used to reliably determine the compliance of a single nuclear power plant with a set of standards or as the basis for judging the adequacy of its safety. A single high-level waste repository, which is to function for thousands of years, is still more difficult to assess quantitatively. The EPA standards should clearly specify that risk assessments are but one of several tools for the evaluation of a given high-level waste repository site and/or facility and that PRAs should be only one factor in evaluating compliance of such a facility with the EPA standards. Expert opinion and deterministic criteria are of considerable importance in judging the acceptability of a specific site.
3. Evaluations of the anticipated performance of the proposed Waste Isolation Pilot Plant indicate that, for the disturbed state, human intrusion is the dominant contributor to risk. Early indications suggested that performance analyses for the proposed Yucca Mountain repository may also show human intrusion to be important. For these reasons, separate considerations for evaluating the impacts of human intrusion should be included. The Committee suggested that the standards be rewritten to separate the evaluation of anticipated repository performance into three parts: (a) the undisturbed repository; (b) the disturbed repository, exclusive of human intrusion; and (c) the repository as it might be affected by human intrusion. This would clearly separate out the issues surrounding human intrusion and permit it to be addressed directly.



Currently, the NRC staff and the ACNW are moving toward, but are not yet at, a consensus over how the EPA standards must be revised. The ACNW will continue its evaluation of the EPA standards.

ACNW Review of the NRC Analysis of the DOE Site Characterization Plan

The stringency of the EPA standards, coupled with their probabilistic base, has led to the need for extensive plans for conducting studies and for collecting the data necessary for the analyses associated with determining whether a given waste disposal site can be demonstrated to show compliance. As a result, the ACNW has devoted considerable time and effort in reviewing the DOE SCP and the NRC staff's review of this plan, the Site Characterization Analysis (SCA). The ACNW review of these documents was, of necessity, less than comprehensive. Rather, the Committee focused on specific critical topics. Members and consultants reviewed relevant material in-depth, using an iterative process with the assistance of the NRC and DOE staffs. The Committee was in general agreement with the overall content of the SCA. However, the Committee had several significant concerns, some of which are summarized below:

- Statements are absent in the SCP addressing the systematic and early identification and evaluation of potentially disqualifying features at the Yucca Mountain Site. Although the SCP is an action plan for site characterization, the Committee believes a much stronger focus should be placed on early detection of potentially disqualifying features. The Committee concluded that the SCA should point to the need in DOE's SCP for an integrated section of the plan that explicitly addresses the activities leading to an evaluation of the characteristics of the site directly related to disqualifying features (e.g., groundwater travel time as stated in the NRC regulations).
- Insufficient attention is given in the SCP to the limitations and uncertainties in the Yucca Mountain data bases, and the associated difficulties in demonstrating that the repository will comply with EPA's high-level waste standards (40 CFR Part 191). Here, the key factor is that the standards, as currently written, are probabilistic and therefore the methods for demonstrating compliance must have a probabilistic base. The approach required to be used includes the construction of a complementary cumulative distribution function (CCDF) and, through this process, a demonstration that the repository complies with the EPA standards. Primary concerns of the ACNW are the uncertainties and limitations in the data to be used to construct the CCDF.

Since the ability to resolve these uncertainties experimentally may well be beyond the capability of the site characterization program, increased consideration should be given to the feasibility of developing deterministic criteria for judging the adequacy of the site relative to the EPA goals. As stated previously, the Committee considers the demonstration of compliance of the proposed repository with the EPA standards to be a major concern.

- The ACNW raised its concern over the delays by DOE in implementing satisfactory quality assurance (QA) programs. The Committee urged that this troublesome issue be resolved promptly, since continued absence of approvable QA systems will increase the burden on the participants in the licensing processes when qualification of data is at issue.

In addition to the above, the Committee offered a number of comments pertaining to other specific aspects of the site characterization program, such as resolving the dilemma of how to determine the characteristics of the Calico Hills Formation, while still maintaining this structure as a barrier between radioactive wastes placed in the repository and the underlying saturated zone, and the need to define the materials to be used in the waste packages and the manner in which these packages will be sealed. The latter information is essential to the evaluation of possible interactions between the waste package and repository materials.

We appreciate the opportunity to participate in today's discussion and look forward to an interesting exchange of information. The success of the nation's nuclear energy program will be measured in part by the skill used to manage nuclear waste. This task clearly requires the participation of people who are expert in a wide range of fields. This meeting is an important contribution to the process and thereby to the quality of the product.

## AGENDA

SYMPOSIUM ON RADIOACTIVE WASTE REPOSITORY LICENSING  
NATIONAL ACADEMY OF SCIENCES/NATIONAL RESEARCH COUNCIL  
AUDITORIUM  
2101 CONSTITUTION AVENUE NW  
WASHINGTON DC

Monday, Sept. 17, 1990

Session IA - Chairman: Frank Parker, Chairman BRWM, Vanderbilt University

- |           |  |                                      |
|-----------|--|--------------------------------------|
| 0900-0915 | Welcome & Introduction   | Frank L. Parker,<br>Chairman, BRWM   |
| 0915-1000 | Keynote Address<br>Repository Performance--The Regulatory<br>Challenge     | James Curtiss<br>Commissioner, USNRC |
| 1000-1040 | Criteria For High-Level Radioactive Waste<br>Disposal In The OECD/NEA Area | J.P. Olivier<br>OECD/NEA             |
| 1040-1100 | Break  |                                      |

Session IB - Chairman: Susan Wiltshire, Member BRWM, J.K. Associates

- |           |  |                           |
|-----------|--|---------------------------|
| 1100-1130 | (How) Can We Demonstrate Compliance With<br>Safety Criteria For Licensing Repositories? --<br>A European Perspective | Charles McCombie<br>NACRA |
| 1130-1200 | The Regulatory Process For Licensing Of A<br>Final Repository For Spent Fuel In Sweden                               | Sören Norrby<br>SKI       |
| 1200-1230 | Assessing The Acceptability of Nuclear Fuel<br>Waste Disposal In Canada  | Kenneth Dormuth<br>AECL   |
| 1230-1330 | Lunch  |                           |

Session IC - Chairman: Charles Fairhurst, Vice Chairman BRWM, University of Minnesota

- |           |   |  |
|-----------|---|--|
| 1330-1410 | United States Approach To High-Level<br>Radioactive Waste Regulation        | Thomas Cotton<br>J.K. Associates   |
| 1410-1425 | NWTRB Concerns With The Licensing Process                                   | Don U. Deere<br>Chairman, USNWTRB<br>Melvin W. Carter<br>Member, USNWTRB |
| 1425-1440 | A Review Of Comments And Recommendations<br>Of The ACNW USNRC               | Dade W. Moeller<br>Chairman, ACNW USNRC                                  |
| 1440-1500 | "11,990 A.D."<br>Environmental Radiation Protection Standards               | Arthur Kubo<br>Robert W. Bishop, Esq.<br>Blue Ribbon Panel               |
| 1500-1515 | Break   |  |
| 1515-1540 | WIPP And Its Compliance With The EPA<br>Standard                            | Wendell Weart<br>Sandia Nat'l Lab.                                       |
| 1540-1600 | Practical Aspects Of Supporting A License<br>Application For Yucca Mountain | Thomas O. Hunter<br>Sandia Nat'l Lab.                                    |

Roundtable I - Chairman: G. Ross Neath, Member BRWM, University of Washington

- |           |                       |                           |
|-----------|-----------------------|---------------------------|
| 1600-1730 | Roundtable Discussion | All Session I<br>Speakers |
|-----------|-----------------------|---------------------------|

Tuesday, Sept. 18, 1990

Session IIA - Chairman: William Colglazier, Member BRWM, University of Tennessee

0830-0900	USEPA Views On Scientific Advisories	Richard Guimond USEPA
0900-0930	Comments on NAS/NRC Report: "Rethinking High-Level Radioactive Waste Disposal"	Robert Bernero USNRC
0930-1000	USDOE Role In Regulatory Issues	John Bartlett USDOE
1000-1030	A Citizens' Group Perspective On Regulatory Aspects Of The HLW And TRU Disposal Programs	Dan Reicher NRDC
1030-1045	Break	
1045-1100	Nevada's View Of The Current Program As It Relates To Licensing A HLW Repository	Robert Loux Nevada
1100-1115	New Mexico Environmental Evaluation Group Perspective On Transuranic and High-Level Waste Disposal Regulations	Robert Neill Director, EEG
1115-1130	Congressional Perspectives On Radioactive Waste Repository Licensing	Benjamin Cooper Staff - U.S. Senate Committee on Energy and Natural Resources
1130-1145	Observations On Integrated HLW Repository Performance Assessment And Related Regulatory Issues	Robert Shaw EPRI
1145-1300	Lunch	

Session IIB - Chairman: Chris Whipple, Member BRWM, Clement International

1300-1330	Perspective On 40 CFR 191 and 10 CFR 60 Based On Results From Waste Package Studies For An Unsaturated Tuff Repository	Lawrence Rampott LLNL
1330-1400	Risk Based Compliance Evaluation Of The Yucca Mountain Site Including Impacts Of Repository Design Features	Paul Gnirk RE/SPEC
1400-1430	Hydrogeologic Considerations In Setting Environmental Standards For HLW	James W. Mercer GeoTrans, Inc.
1430-1445	Break	
1445-1510	Uncertainty And The Implementation Of Regulatory Standards	David L. Pentz Golder Assoc., Inc.
1510-1535	Considerations Based On The USEPA Science Advisory Board Subcommittee 1984 Report On 40 CFR 191	Robert Budnitz FRA, Inc.
1535-1615	Can Alternative Dispute Resolution Approaches Help?	Gail Bingham Conservation Found.

Roundtable II - Chairman: Frank Parker, Chairman BRWM, Vanderbilt University

1615-1645	Improving the Licensing Process for the Disposal of TRU and High-Level Radioactive Waste	All Session I & II Chairmen
1645-1700	Closing Remarks	Frank L. Parker Chairman, BRWM



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON NUCLEAR WASTE  
WASHINGTON, D.C. 20556

October 10, 1990

Mr. Richard J. Guimond  
Assistant Surgeon General, U.S. Public Health Service  
Director, Office of Radiation Programs  
U.S. Environmental Protection Agency  
Washington, D.C. 20460

Dear Mr. Guimond:

We were pleased to receive your letter of August 6, 1990, as well as your telephone call of the same date, indicating a desire to work with this Committee in resolving certain issues related to the Environmental Protection Agency (EPA) standards for the disposal of high-level radioactive wastes in a geologic repository. In response to your questions pertaining to the letter of May 1, 1990, submitted by this Committee to Chairman Kenneth M. Carr, U.S. Nuclear Regulatory Commission (NRC), we offer the following comments. They correspond to the items as enumerated in your letter.

1. We believe that the EPA standards can be interpreted as being organized in a hierarchical structure. This is based on the assumption that the highest level expression in your hierarchy is a qualitative goal, that is, that the risks to future generations over the first 10,000 years due to the disposal of high-level radioactive wastes in a repository should be no greater than "the risks that would have existed if the uranium ore had not been mined . . . ." We note, however, that this statement is not included in the standards, nor is it identified as the highest level goal. The statement is included only in the "Summary" and the "Supplementary Information" that accompanies the original standards as published in the Federal Register.

What we interpret as the next level, which is quantitative and is a part of the standards, is the statement that there should be no more than 1,000 premature deaths over the first 10,000 years which are attributable to placement in a repository of the high-level wastes from 100,000 metric tons of reactor fuel. We fail, however, to see the connection or comparability between this statement and what we interpret as the highest level goal. We also fail to see the quantitative relationship between this requirement and the limits on the releases of specific radionuclides from a disposal facility which are probabilistic and serve as what we interpret to be the third level in the hierarchy.

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Our concern with your apparent hierarchical structure is that the lower level quantitative statements (or standards) appear to be more stringent than the highest level qualitative statement. To assist us in better understanding the approach you have taken, it would be helpful if your staff could (1) state whether we have correctly interpreted the hierarchical structure of your standards, and (2) provide us with the rationale and, indeed, the calculations and assessments that served as a basis for developing the lower level quantitative standards. With respect to the latter request, we note that certain changes have occurred that may impact upon the validity of your earlier calculations. These changes include: (a) analyses of "real" repository sites have shown them to be more complicated than your staff may have assumed for the hypothetical site used in your analyses, (b) the potential impact of indoor radon, which was only generally recognized subsequent to your original assessment, may need to be factored into your risk evaluations, and (c) major advances in environmental modelling techniques over the last few years.

2. (a) We concur with your assumption that a disturbance can occur at any time during the initial 10,000-year period. In recognition of this fact, you have specified the radionuclide release limits in your standards in a manner so that it does not make any difference whether the entire release occurs within a single year or is spread out over time. We do not concur, however, that this makes it difficult to apply annual risk limits under these types of circumstances.

The principal basis for our position is the guidance provided by the International Commission on Radiological Protection (ICRP) in its Publication 46. In this report, the ICRP recommends that the risks from releases from the undisturbed performance of a waste repository be controlled through the application of annual dose limits. The ICRP further recommends that the risks from releases accompanying the disturbed state (classified as "probabilistic events") be limited on a similar basis, that is, through the application of annual risk limits. In both cases, the limits would apply to the critical population group.

If you maintain your position that application of an annual risk limit to releases occurring during the disturbed state is not workable, an alternative approach would be to apply some form of "accident or event" risk limit to these types of occurrences. This would be comparable to the approach being used in safety assessments of nuclear power plants where annual dose limits are applied for the control of radionuclide releases associated with routine operations and (single-event) risk limits are applied to releases occurring as a result of accident situations.

October 10, 1990

In making these suggestions, we clearly recognize that there are definite limitations in comparing the standards and approaches used in the regulation of a nuclear power plant to those needed for a high-level radioactive waste repository. Nonetheless, where the transfer of knowledge and experience from one type of nuclear facility to another can be beneficial, such analogies should be encouraged.

(b) We agree that the licensing organization should have the authority for defining the critical population group.

Having stated this, however, we also believe that it would be helpful if the EPA staff could identify and justify the critical population group assumed to be exposed in setting what we have referred to as your intermediate level goal. If we interpret the situation correctly, such information would permit estimation of the average annual risk (dose) limit that corresponds to this goal. In a similar manner, we would appreciate knowing the critical population group that was assumed in calculating the probabilistic radionuclide release limits specified in Table 1 of your standards.

Another item of information that would be helpful would be to know how the collective doses associated with the establishment of these radionuclide releases were calculated. To be specific, was a cutoff used, as was suggested by the ICRP in its Publication 46 and as has more recently been suggested by the National Council on Radiation Protection and Measurements in its Report No. 91, or was the full range of dose rates included in making these estimates?

Please note that our interest in being able to define a critical population group and to estimate this group's associated permissible dose rates is in line with our understanding of the guidelines recommended by the ICRP and by radiation protection authorities in other countries of the world for high-level waste repositories. We believe the guidance provided by these groups is sound and represents a satisfactory basis on which to judge the acceptability of the health risks associated with radioactive waste disposal facilities.

3. In recommending that a disposal facility be addressed as a system, we reaffirm our position that a properly organized system requires a consistent hierarchical structure. The application of remedial actions beyond retrievability of the emplaced waste is an integral part of such a system.

4. (a) We concur with your statement that "what is really important is the total anticipated impact of repository performance." The reason that we called for specific attention to human intrusion is that preliminary performance assessments for the WIPP facility have shown that this concern is the dominant contributor to the risks to the public. We have no data that show the same

October 10, 1990

situation is valid for the proposed Yucca Mountain repository, but it is possible that this will prove to be true. In fact, the EPA staff may have foreseen this situation when it included in the standards the statement that ". . . it is possible to conceive of intrusions (involving widespread societal loss of knowledge regarding radioactive wastes) that could result in major disruptions that no reasonable repository selection or design precautions could alleviate." We are aware that your standards state that "The Agency believes that the most productive consideration of inadvertent intrusion concerns those realistic possibilities that may be usefully mitigated by repository design, site selection, or use of passive controls . . .," but what constitutes realistic possibilities is open to multiple interpretations.

Again, what we are suggesting is directly comparable to the approach being used in the regulation and assessment of the public health risks from nuclear power plants. For a waste facility, the undisturbed state would correspond to a nuclear power plant during normal operations, and the disturbed state would correspond to a plant in which an accident has occurred. In the case of risk assessments for nuclear plants, it was found that the difficulties and uncertainties in addressing certain types of accidents were so large that the approach that has been adopted is to analyze their contributions separately. In these cases, estimates of the associated risks are based on the best judgments of expert groups. We believe a similar approach (i.e., using expert judgment) is almost essential and would be appropriate for assessing the potential impact of human intrusion on the performance of a waste repository.

(b) The basis for our comments on borehole sealing was that, if we assume (as you indicate in the guidance provided in Appendix B of your standards) that exploratory procedures will be "adequate for the intruders to soon detect, or be warned of, the incompatibility of the area with their activities," then the need for a carefully sealed borehole would be recognized quickly and action would be taken to ensure that proper corrective measures were taken. Your consideration of removing this requirement from the standards is welcomed. We concur.

(c) Our statement calling for "more realistic assessments" of the potential impacts of human intrusion at the proposed Yucca Mountain site was based in part on the guidance provided in Appendix B of the current EPA standards, which states that a borehole will create "a ground water flow path with a permeability typical of a borehole filled by soil or gravel that would normally settle into an open hole over time -- not the permeability of a carefully sealed borehole." Under these constraints, we believe it might be difficult to demonstrate compliance of any facility with the EPA standards. We are pleased to learn that the licensing authority (NRC) will make the



October 10, 1990

determination as to the appropriate realism for assessments regarding human intrusion.

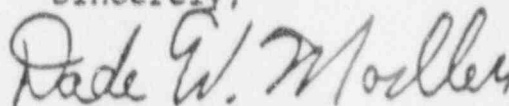
At the same time, however, we remain concerned with this approach. The guidance in Appendix B to the EPA standards includes detailed discussions of borehole seals and human intrusion. As a result, we believe that your Agency has preempted the definition of reasonable approaches in assessing these matters. Any deviation by the licensing authority from your guidance will almost certainly be viewed by the public as an exception to the standards.

(d) We appreciate the comments provided in your letter related to the role of passive controls, such as markers and records, in reducing the likelihood of human intrusion. We also concur with the statement in Appendix B of the EPA standards that ". . . passive institutional controls can never be assumed to eliminate the chance of inadvertent and intermittent human intrusion into . . ." waste disposal sites. We concur that it is the role of the implementing agency to determine the degree to which these factors should be considered to control human intrusion.

5. The ACNW understands the need to include probabilistic requirements in the EPA standards. We believe it is important to recognize that (a) the probabilistic requirements in your standards apply only to the lowest set of goals in your hierarchy, and (b) contrary to what is practiced in comparable situations (e.g., the NRC safety goals for nuclear power plants), your requirements include a risk aversion factor. What we believe needs to be explicitly stated is that the probabilistic approach can be an important factor in regulating a waste disposal facility, but it should not be the sole basis for decisionmaking. Equal or greater weight can and should be placed on the development and application of deterministic requirements and, when necessary, the use of expert judgment. We are pleased to note that your staff is using a deterministic approach in developing requirements for the control of doses to the public due to the contamination of drinking water as a result of radionuclide releases from a waste facility.

We thank you for your thoughtful and constructive letter. As soon as you and your staff have had an opportunity to review our responses to your questions, we would welcome your reply and an opportunity to meet and discuss these matters with you in additional detail.

Sincerely,



Dade W. Moeller  
Chairman

ITEM B

DRAFT WASTE FORM TECHNICAL POSITION

ADVISORY COMMITTEE ON NUCLEAR WASTE MEETING  
WITH COMMISSIONERS  
DECEMBER 13, 1990

Draft Waste Form Technical Position

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2. ACNW Report, Revision 1 of Draft Technical Position on Waste Form, dated September 6, 1990	2-4
3. EDO Response to ACNW September 6, 1990 letter report on Draft Technical Position on Waste Form, dated October 15, 1990	5

BACKGROUND:

The ACNW (and before, the applicable ACRS Subcommittee) have reviewed the subject of this technical position several times. The Committee noted in its review of Revision 1, which was conducted during its 23rd meeting, that many of the points previously called to the attention of the staff were reflected in this latest document. While the Committee identified several concerns in need of resolution, it concluded, however, that the publication of the Technical Position need not be held up pending resolution.

The Executive Director for Operations has sent a memorandum to the ACNW dated October 15, 1990 responding to the Committee's comments, indicating that the publication of the revision to the Technical Position is to proceed as soon as possible.

Copies of the Committee's September 6, 1990 letter report and the EDO's October 15, 1990 memorandum in response are attached.

Cognizant ACNW Member: M. J. Steindler  
Cognizant ACNW Staff: H. J. Larson



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

September 6, 1990

The Honorable Kenneth M. Carr  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Dear Chairman Carr:

SUBJECT: REVISION 1 OF DRAFT TECHNICAL POSITION ON WASTE FORM

During its 23rd meeting on August 29 and 30, 1990, the Advisory Committee on Nuclear Waste (ACNW) reviewed a draft version of Revision 1 of the Technical Position on Waste Form, prepared by NRC's Division of Low-Level Waste Management and Decommissioning. The Committee also had the benefit of discussion with the NRC staff on this matter.

The revision represents a significant expansion of the previous document on this same subject and reflects many of the points that were called to the attention of the NRC staff during previous ACNW and ACRS subcommittee meetings. Owing to the importance to public health and safety that is now properly attached to the quality of the low-level waste form, we conclude that this technical position, when fully implemented, can serve as a useful guide in the evaluation of waste forms used in low-level waste disposal. We believe that the required reporting of mishaps will be especially useful.

Listed below are several concerns that the Committee has on this subject. However, we believe that publication of the Technical Position need not be held up pending resolution of these concerns. To assist in their resolution, we recommend that the NRC staff consider the detailed discussions held during the ACNW meeting of August 29, 1990.

1. The applicable regulation (10 CFR Part 61) places emphasis on the physical stability of the waste form (Class B and Class C) with the intent that by this means access of water to the waste can be controlled. There is no requirement in Part 61 for a specified resistance of the waste form to leaching of radionuclides by ground water. We believe that an important attribute of the waste form is its behavior related to migration of radionuclides into the environment. We believe a revision of Part 61 addressing this point is needed, but

until that is completed, the Technical Position should be amended to reflect more directly the attention that leaching resistance should be given. The almost exclusive focus of the Technical Position on mechanical integrity of the waste form and the effect of various phenomena (e.g., thermal cycling, radiation, and immersion in water) on that integrity should be supplemented by requirements that leach resistance, as measured by a specified separate test, should be maintained in parallel with mechanical strength after the waste is subjected to these phenomena.

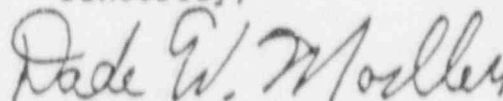
2. The testing requirements cited in the revised Technical Position should be representative of conditions likely to be encountered in a shallow land burial site. The primary mobilizing agent is ground water which could be more aggressive in enhancing movement of radionuclides than the distilled water or synthetic sea water now specified in the Technical Position. We believe that the specific test conditions cited in the Technical Position, now oriented only to structural impact, should be complemented by additional conditions that relate to the ground water chemistry of the waste. Further, biodegradation tests should be specified for cementitious waste matrices using bacteria that are likely to affect cement as well as the organic component of the waste.
3. We believe that the provisions for tests of the radiation resistance of waste forms may not be sufficiently conservative when considering the potential for hydrogen generation in closed spaces. The NRC staff is urged to reexamine this topic to ensure that slow buildup of hydrogen from water-bearing wastes in sealed containers does not become a problem for long-term, safe disposal.
4. We believe that insufficient attention has been given to the testing of aged waste forms. Many of the matrices, including concrete, that are used to contain wastes continue to change chemically and physically long after their preparation. Owing to the longer term focus (i.e., 300 years) of the waste integrity requirement, definition of the behavior of waste specimens that simulate aged waste forms appears appropriate for inclusion in the Technical Position where such testing appears feasible and reasonably reliable.
5. The Committee notes that a part of the regulatory control over low-level waste disposal is based on Part 20 regulations (10 CFR 20.311). We urge that the NRC staff examine the revisions in Part 20 that affect low-level waste and ensure that the Technical Position and the updated Part 20 are compatible.
6. The Committee is aware that the newly developed criteria for compressive strength of acceptable cementitious waste forms

September 6, 1990

[500 psi] lacks strong technical justification but was selected to preclude the use of unstable waste forms. The NRC staff should include in the Technical Position recognition that the compressive strength that is initially called for may not be retained by the waste form for its required life. Long-term degradation of compressive strength to lower levels, but not less than the approximately 60 psi required for other waste forms, may be acceptable.

We hope you will find these comments useful.

Sincerely,



Dade W. Moeller  
Chairman

Reference:

U.S. Nuclear Regulatory Commission Draft Technical Position on Waste Form (Revision 1) dated June 1990, Prepared by Technical Branch, Division of Low-Level Waste Management and Decommissioning (Predecisional)



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

OCT 15 1990

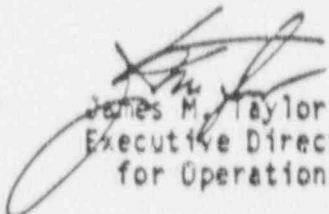
Dade W. Moeller, Chairman  
Advisory Committee on Nuclear Waste  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

OCT 15 1990

Dear Chairman Moeller:

I am responding to your September 6, 1990, letter to Chairman Carr on the draft revision to the "Technical Position (TP) on Waste Form". Your letter contained several suggestions and recommendations for improving the TP and the Nuclear Regulatory Commission's regulation, 10 CFR Part 61, for land disposal of low-level radioactive waste. We agree with your observations on the importance of the quality of the waste form and will proceed as you suggest with the publication of the revision to the TP, as soon as possible. We will also consider your other recommendations for incorporation into future revisions to the regulations or staff guidance documents and plan to discuss the issues you have identified at future Committee meetings.

Sincerely,

  
James M. Taylor  
Executive Director  
for Operations

cc: Chairman Carr  
Commissioner Rogers  
Commissioner Curtiss  
Commissioner Remick  
SECY

ITEM C

STATUS REPORT ON WORKING GROUPS

1. C-14 TRANSPORT
2. HUMAN INTRUSION
3. MIXED WASTE
4. POTENTIAL WORKING GROUP MEETINGS



Advisory Committee on Nuclear Waste  
With Commissioners  
December 13, 1990

EPA's High-Level Waste Standards

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4. ACNW Report, NRC Staff's Approach for Dealing With Uncertainties in Implementing the EPA HLW Standard, dated August 3, 1990	9-11
5. Paper presented at the NAS/NRC Symposium on Radioactive Waste Repository Licensing, Comments of the Advisory Committee on Nuclear Waste of the U.S. Nuclear Regulatory Commission, Revision 1, September 17, 1990 (With Symposium Agenda attached for information/perspective).	12-18
6. ACNW letter to R. J. Guimond, Assistant Surgeon General, USPHS, and Director, Office of Radiation Programs, EPA, dated October 10, 1990	19-23

BACKGROUND:

Since its last briefing, the Committee has sent several letter/reports to the Commission with regard to its concerns with the current set of proposed EPA standards. These concerns have primarily been directed to the Committee's unanimous belief that these Standards (40 CFR Part 191) are overly stringent, wasteful of resources and cannot be implemented. The Committee concludes that the standards need to be revised and that now is the time to accomplish this task. Copies of these letters/reports are attached.

SCHEDULE AND OUTLINE FOR DISCUSSION  
ACNW WORKING GROUP MEETING  
ON CARBON-14  
OCTOBER 26, 1990  
(OPEN MEETING)

October 26, 1990, Room P-110, 7920 Norfolk Avenue, Bethesda, Maryland

- 1) 8:30 - 8:45 a.m. Opening Remarks by Working Group Chairman
  - 1.1 Opening Remarks (MJS/HJL)
- 2) 8:45 - 9:15 a.m. Presentation of A.D. Little Report Prepared for the Environmental Protection Agency - T. Bunton, EPA, ORP
  - 2.1 A. D. Little Report Review
- 3) 9:15 - 9:45 a.m. Carbon-14: Background and General Considerations L. Ramspott, LLNL
  - 3.1) Sources
  - 3.2) Perspective vis-a-vis other gaseous effluents
  - 3.3) General background and introduction to subsequent speakers' topics
- 9:45 - 10:30 a.m. Carbon-14: Release From a High-Level Waste Geologic Repository - R. von Konynenburg, LLNL
  - 4.1) Inventory - chemical form, physical distribution, etc.
  - 4.2) Applicability to Current DOE Siting Studies
- 10:30 - 10:45 a.m. BREAK
- 5) 10:00 - 11:30 p.m. Continuation of Dr. von Konynenburg Presentation
- 6) 11:30 - 12:30 p.m. Carbon-14: Release and Transport from a Nuclear Waste Repository - W. Lee, LBL
  - 6.1) Dr. Lee's presentation will follow Carbon-14 release from partly failed container to the atmosphere.
- 12:30 - 1:30 p.m. LUNCH
- 7) 1:30 - 2:30 p.m. Carbon-14: Regulatory Requirements - C. Pflum, SAIC
  - 7.1) Relationship of releases to limits - realistic?
  - 7.2) "High Costs and Negligible Benefits"

- 8) 2:30 - 3:30 p.m. Round Table Discussion - solicit input from members, consultants, speakers, DOE, NRC, and State of Nevada. (Invite to table/microphones) - M. J. Steindler, ACNW
- 9) 3:30 - 3:45 p.m. Working Group Future Strategy - Discuss possible activities, future meeting agenda, administrative items, as appropriate - M. J. Steindler, ACNW
- 10) 3:45 p.m. ADJOURN

Advisory Committee on Nuclear Waste  
Meeting with Commissioners  
December 13, 1990  
Working Group on Human Intrusion

BACKGROUND

In March 1990 the Committee heard comments on the difficulty of assessing the impacts of human intrusion on the WIPP site and subsequently assessing the compliance of the WIPP with the EPA standards. Preliminary performance assessments conducted for WIPP indicated human intrusion was the dominant contributor to risk.

A Working Group on Human Intrusion met on October 23, 1990 to discuss information relevant to human intrusion of a high-level waste repository and whether it is reasonable to assume that human intrusion could also be a problem in the performance analyses for any HLW repository.

Making presentations at the meeting were:

Mr. Floyd Galpin, Environmental Protection Agency  
Mr. Steve Frishman, State of Nevada Department of Nuclear Waste  
Ms. Kate Trauth, Sandia National Laboratories  
Dr. James Channell, New Mexico Environment Evaluation Group  
Mr. Rudy Baier, Mr. John Bebout, and Mr. Jean Juilland, Bureau of Land Management

Specific topics of discussion included the Environmental Protection Agency's guidance in Appendix B of 40 CFR Part 191, the possibility of credit for active institutional control to prevent human intrusion, and the factoring of human intrusion into performance assessments. Some observations from the meeting include:

1. Because the WIPP will not be licensed under the requirements of 10 CFR Part 60, care must be exercised in using evaluations of the anticipated performance of the WIPP as an example of potential problems in performance assessments of generic HLW repositories.
2. Statistics on drill hole densities for a generic HLW site as provided in 40 CFR Part 191, Appendix B may be misleading when applied to specific HLW sites.
3. The sealing of boreholes on federal lands is controlled and monitored to prevent communication of fluids and gases over the depth of the borehole. Sealing of boreholes on private land is complicated by requirements that vary among the States. The guidance in Appendix B of 40 CFR Part 191 does not acknowledge these differences.

4. The first line of defense against inadvertent human intrusion is to avoid areas that have the potential for valuable resources that would make them likely candidates for human intrusion. If the siting criterion in 10 CFR Part 60.122 (c)(17) is followed, this first line of defense will be established.

The Committee plans to schedule future meetings on the topic of human intrusion to examine how analyses of human intrusion events should be integrated into the performance assessment for a HLW repository. They will also follow staff reviews of site characterization activities directed toward natural resource assessments and staff guidance on acceptable natural resource investigation methods.

ADVISORY COMMITTEE ON NUCLEAR WASTE MEETING  
WITH COMMISSIONERS  
DECEMBER 13, 1990

Working Group on Mixed Waste

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BACKGROUND:

This Working Group was formed in response to an interchange earlier in the year between Commissioner Curtiss and the ACNW Chairman. The purpose of the December 11th meeting was to gather information on the technical and regulatory considerations for the disposal of mixed wastes, ie., waste that has both a radioactive and hazardous component and is dually regulated by both the NRC and EPA. The Working Group was to consider the similarities and differences between these two sets of regulations, their application in practice and other related topics.

The Working Group heard discussions on the following topics:

- RCRA and its applicability to the resolution of the mixed waste issue.
- Discussions as to how pertinent NRC and EPA regulations are satisfied by the jointly issued NRC-EPA guidelines relevant to the disposal of mixed wastes.
- Significance of resolving the mixed waste issue insofar as compliance with the 1985 LLRWPA milestones.
- Perspectives of the user and generator community, electric utilities, disposal site operators and the State of Nebraska on the magnitude of the problem and relative significance of the issues involved.
- Recommended courses of action to permit timely disposition of relevant issues.

26th ACNW Meeting  
December 12-13, 1990

Upon conclusion of the meeting, the Working Group will determine, based on the presentations heard, other inputs and individual evaluation, if a properly evaluated technical response to Commissioner Curtiss can be made at this time on this complex issue or whether additional input is required.

Cognizant ACNW Member: D. W. Moeller  
Cognizant ACNW Staff Member: H. J. Larson



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON NUCLEAR WASTE  
WASHINGTON, D.C. 20565  
SCHEDULE AND OUTLINE FOR DISCUSSION  
ACNW WORKING GROUP MEETING  
ON MIXED WASTE  
DECEMBER 11, 1990  
(OPEN MEETING)

December 11, 1990, Room P-110, 7920 Norfolk Avenue, Bethesda, Maryland

- 1) 8:30 - 8:45 a.m. Opening Remarks by Working Group Chairman
  - 1.1 Opening Remarks (DWM/HJL)
  
- 2) 8:45 - 9:45 a.m. Mixed Wastes - An Overview of the Problem  
A. Pasternak, Technical Director, California  
Radioactive Materials Management Forum
  - 2.1 Magnitude of the problem vis-a-vis  
hazardous and low-level radioactive  
wastes (LLRW)
  - 2.2 Perspectives of the user and generator  
community (risks, relationship to  
LLWPAAs milestones, penalties for  
failure to provide acceptable  
solution, etc.)
  
- 3) 9:45 - 10:30 a.m. Current EPA Position on RCRA and Mixed Wastes  
S. Rudzinski, Branch Chief, OSW, EPA and  
R. Lashier, Mixed Waste Coordinator, EPA
  - 3.1) Brief review of RCRA and its relationship  
to LLRW
  - 3.2) Technical description of jointly (EPA/NRC)  
acceptable mixed waste disposal site
  
- 10:30 - 10:45 a.m. \*\*\*\*\* BREAK \*\*\*\*\*
  
- 4) 10:45 - 11:15 a.m. Continuation of EPA Presentation
  
- 5) 11:15 - 12:15 p.m. Current NRC Position on Mixed Wastes  
John Austin, Branch Chief, NMSS, NRC
  - 5.1) Relevance of mixed waste issue resolution  
to compliance with 1985 LLWPAAs  
requirements
  - 5.2) Technical description of jointly (NRC/EPA)  
acceptable mixed waste disposal site
  
- 12:15 - 1:00 p.m. \*\*\*\*\* LUNCH \*\*\*\*\*



ACNW MEETING WITH THE COMMISSIONERS  
DECEMBER 13, 1990  
POTENTIAL WORKING GROUP MEETINGS

The following are working group meetings anticipated to take place in the next few months:

ACNW Working Group Meeting on Expert Judgment

January 25, 1991 - The Working Group will review and discuss the use of expert judgment in conducting performance assessments for the proposed HLW repository and LLW sites; benefits and limitations related to the use of expert judgment will be explored.

ACNW Working Group Meeting on Computing Collective Doses

February 19, 1991 - The Working Group will review and discuss methods of calculating collective population doses from exposure to low levels of ionizing radiation. Discussions with NCRP, ICRP, National Research Council's BEIR Committee, IAEA, the NRC and EPA staffs are anticipated.

ACNW Working Group on Geologic Dating

March 1991 - (Tentative) - The Working Group will review and discuss problems and limitations with various Quaternary dating methods to be used in site characterization of a HLW repository.

ACNW Working Group on Long-Term Climate Change

(Date To be Decided) - The Working Group will review and discuss potential long-range climate changes and their impact on performance assessments and ultimately on the suitability of the proposed high-level waste repository.

ACNW Working Group on the DOE/USGS White Paper on the Geophysical Aspects of the Repository Site Characterization Plan

(Date To be Decided) - The Working Group plans to discuss the results of the NRC staff's review of the DOE/USGS "white paper" on the "Status of Data, Major Results, and Plans for Geophysical Activities, Yucca Mountain Project." This report is important as it relates to an important theme on integration of planned tests, studies, and existing data in the NRC staff's comments on the DOE Site Characterization Plan.

TRANSMITTAL TO: X Document Control Desl., 016 Phillips  
 ADVANCED COPY TO: \_\_\_\_\_ The Public Document Room  
 DATE: 12/17/90  
 FROM: SECY Correspondence & Records Branch

Attached are copies of a Commission meeting transcript and related meeting document(s). They are being forwarded for entry on the Daily Accession List and placement in the Public Document Room. No other distribution is requested or required.

Meeting Title: Periodic Mtg with Advisory Cmte  
on Nuclear Waste

Meeting Date: 12/13/90 Open X Closed \_\_\_\_\_

Item Description*	Copies Advanced to PDR	DCS Copy
1. TRANSCRIPT	1	1
2. <u>Memo Fraley to Chilke</u> <u>dtd 12/5/90</u>	<u>1</u>	<u>1</u>
3. _____	_____	_____
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