

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

**Title: MEETING WITH ADVISORY COMMITTEE ON
NUCLEAR WASTE (ACNW) - PUBLIC MEETING**

Location: Rockville, Maryland

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1 UNITED STATES OF AMERICA
2 NUCLEAR REGULATORY COMMISSION

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4 MEETING WITH ADVISORY COMMITTEE
5 ON NUCLEAR WASTE (ACNW)

6 ***

7 PUBLIC MEETING

8
9 Nuclear Regulatory Commission
10 Commissioners' Conference Room
11 One White Flint Plaza
12 11555 Rockville Pike
13 Rockville, Maryland

14
15 Thursday, November 16, 1995
16

17 The Commission met in open session, pursuant to
18 notice, at 2:04 p.m., the Honorable SHIRLEY A. JACKSON,
19 Chairman of the Commission, presiding.

20
21 COMMISSIONERS PRESENT:

22 SHIRLEY A. JACKSON, Chairman of the Commission
23 KENNETH C. ROGERS, Member of the Commission
24

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1 STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

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John C. Hoyle, Secretary

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Karen D. Cyr, General Counsel

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P R O C E E D I N G S

[2:04 p.m.]

CHAIRMAN JACKSON: Good afternoon.

Today, we are meeting with the Advisory Committee on Nuclear Waste to be briefed on several technical issues related to the management and disposal of radioactive waste. The proper management of nuclear waste is vital for the protection of public health and safety. The Commission continues to believe that a technically sound waste management program is an integral part and critical part of this country's nuclear program.

The Commission welcomes technical input from all sources on ways to improve its regulatory program for radioactive waste and is particularly appreciative of the advice we have received from the ACNW over the past several years. The Commission will continue to seek sound technical advice that will assure the safe management and disposal of this country's radioactive waste and the Commission looks to the ACNW to provide it with that type of sound technical advice.

In today's environment of shrinking resources, we must continually assure ourselves that the Commission is receiving the highest level of technical advice in the most efficient and effective manner possible.

In looking over the agenda for today's meeting, it

1 appears that we have a fairly large number of topics. I
2 hope we can move expeditiously through them so, Commissioner
3 Rogers, do you have any input?

4 COMMISSIONER ROGERS: Nothing right now, no.

5 CHAIRMAN JACKSON: If not, I will turn it over to
6 you, Dr. Pomeroy.

7 DR. POMEROY: Thank you very much.

8 Madam Chairman, Commissioner Rogers, it is a
9 pleasure for the ACNW to report to you today on several
10 waste issues that we feel are of significant importance to
11 the program. In accordance with your suggestions, we
12 propose the following agenda, looking at our first slide.

13 We are going to first going to report to you on
14 four elements that essentially constitute work in progress.
15 In particular, we are going to talk about, first of all,
16 some ideas that we are developing on the National Academy of
17 Sciences report on the Yucca Mountain standards. The second
18 item we are going to talk about is residual levels of
19 contamination. The third is NRC's low-level waste program
20 options paper, SECY-95-201. And the fourth item is the ACNW
21 estimate of our priorities currently, given the changing
22 scenarios that are taking place within the DOE's program and
23 resulting changes in our own programs as well as budget
24 reductions on all sides.

25 Following those four items, we would then like to

1 discuss three letters that we recently have written to you.
2 First of all, lessons learned from the Ward Valley low-
3 level waste siting process. Secondly, the high-level waste
4 research in hydrology report and groundwater travel time
5 report and, thirdly, regulatory issues in low-level waste
6 performance assessment.

7 As you have commented, this is a very full
8 schedule and we will make every effort to fit into the
9 available time our commentary. I would like to emphasize
10 that for the work in progress discussions we, in general,
11 have not had time to develop at this point a consensus
12 opinion and so our remarks must be treated at this point as
13 comments of the individual speakers involved. They do not
14 represent consensus committee comments.

15 I would also say that you -- I was going to say
16 perhaps but you almost certainly will see differences of
17 opinion expressed here today because we have not reached
18 that consensus area.

19 We would like to treat -- this is a new format for
20 us in the sense that we haven't in the past reported on
21 works in progress and we would like to propose some format
22 for doing that.

23 What we would like to suggest is that we would
24 like to treat each of the four elements of the work in
25 progress one at a time. We would like to introduce the

1 topic and discuss where we stand with it briefly, discuss
2 what some of our concerns are and then at that point ask --
3 essentially respond to you questions if that is a
4 satisfactory approach. We could expand our presentation in
5 any given area if you would like us to do that as an
6 alternative.

7 When we have discussed this agenda, we decided
8 that it would be most useful in terms of exchanging
9 information to follow that proposed format.

10 If you have no objections, we would like to
11 continue with that.

12 CHAIRMAN JACKSON: Yes.

13 DR. POMEROY: I would like to turn then to
14 essentially our status report on work in progress. And the
15 next slide essentially and the next two after this
16 essentially list the three questions from the Energy Policy
17 Act of 1992 that were addressed -- that the National Academy
18 of Sciences National Research Council report addressed
19 specifically in terms of the direction that was received
20 from Congress.

21 That first question, whether a health-based
22 standard based on doses to individual members of the public
23 from releases to the accessible environment will provide a
24 reasonable standard for protection of the health and safety
25 of the general public. In the slide package, you will note

1 there is a "Y" to the left of that question. That is the
2 one word answer that the National Academy of Sciences
3 provided in their report and it also represents the answer
4 that we suggested be incorporated in NRC advice to our input
5 to the academy of sciences in a letter dated February 5,
6 1993, to the then-Chairman Selin.

7 Similarly, if we go on to the next slide, the
8 second question relates to a system of oversight in the
9 post-closure domain for the repository as to whether that
10 system can be developed based on institutional controls that
11 will prevent an unreasonable risk of breaching the
12 repository's engineered or geologic barriers or increasing
13 the exposure of individual members of the public to
14 radiation beyond allowed limits.

15 The Academy's answer to that question was, no.
16 Our answer in February of 1993 was also, no.

17 Thirdly, the third question, whether it was
18 possible to make scientifically supportable predictions of
19 the probability that the repository's engineered or geologic
20 barriers would be breached as a result of human intrusion
21 over a period of 10,000 years. Again, the Academy's answer
22 was, no. This Committee's answer in 1993 was also, no.

23 What I would like to do --

24 CHAIRMAN JACKSON: Can I ask you a question?

25 DR. POMEROY: Surely.

1 CHAIRMAN JACKSON: What is your view on the
2 Academy's recommendation of assessing radiological impacts
3 beyond the 10,000-year time frame?

4 DR. POMEROY: I have an opinion on that and I
5 would like to give it to you. I would also like to ask
6 Dr. Garrick, first, to give you his opinion, if I may.

7 DR. GARRICK: Well, the way I guess I would answer
8 that is I wrote a paper about two years ago where I
9 indicated that I thought it was appropriate to attempt to
10 calculate the peak dose. Obviously, with full realization
11 that such a calculation would have a great deal of
12 uncertainty. But I like to distinguish the issue of
13 calculating a safety parameter from the issue of what we
14 should use as a basis for regulation.

15 And I think that in fact when you are doing this
16 type of analysis, there are a number of calculations you
17 want to do that are not necessarily a part of the regulatory
18 requirements and I think that is valuable because it adds
19 credibility, it gives you a basis for reducing the
20 uncertainty, very often, of the calculations you do do for
21 compliance.

22 So my position on what the Academy has done here
23 is that they have brought to the attention that this is
24 information that we ought to try to develop and I think that
25 a lot of people when we first went into this sort of thing

1 didn't think that peak doses were going to occur so far out
2 in time. So I believe that is information you should
3 calculate but I also very much believe that that is not
4 necessarily what you should regulate against.

5 CHAIRMAN JACKSON: Okay, thank you.

6 DR. POMEROY: In fact, while I certainly agree
7 with what John said with regard to the longer time frame, I
8 think there is also a point to be made when we start to talk
9 about periods of time like 100,000 years and making
10 meaningful predictions. Those bands of uncertainty that
11 John refers to would get very large and I am not sure -- I
12 am certain, in fact, that we won't have a -- we may have
13 something that is meaningful from a science standpoint to
14 tell us something about the exposure levels at that point in
15 time but to include that in any way in a regulatory
16 framework would seem to me to open the door to a great deal
17 of controversy that probably is unnecessary in the -- in an
18 overall regulation program.

19 I would like to see us regulate in a much shorter
20 time frame than the 100,000, few hundred thousand years.
21 Perhaps 10,000 is the right number, perhaps a number shorter
22 or even possibly a little longer is appropriate. But it
23 doesn't seem to me that the 100- -- few hundred thousand
24 year time frame which is what we come out with may be
25 appropriate.

1 CHAIRMAN JACKSON: Okay.

2 DR. STEINDLER: I wouldn't want you to think
3 though that we are in total agreement on this issue. We
4 have, in fact spent some time talking at each other about
5 this. It seems to me that from the regulators' standpoint,
6 it is of interest to do the calculation. And, by the way, I
7 was somewhat disappointed in the National Academy report
8 because it urged the calculation but it doesn't tell you
9 much more than that. It just says, go do the calculation
10 but it doesn't tell you what to do with it.

11 If it turns out that you in fact do the
12 calculation and the dose, the peak dose is very high at
13 regulatory times and is very close to the 10,000 year limit
14 that currently exists, that might be a useful guide to begin
15 to think a little bit about what can be done to either
16 reduce the dose or to push the time up.

17 Other than that, it seems to me that there is no
18 direct application that you can use the information. It is
19 too uncertain to regulate with. While it may be interesting
20 and stimulate some additional research in order to perhaps
21 do something with it as it would be if the value was close
22 in and quite high, beyond that it seems to me from the
23 regulator standpoint or from the standard-setting
24 standpoint, I don't find it a particularly useful exercise.

25 CHAIRMAN JACKSON: Thank you.

1 DR. POMEROY: Turning to the next slide, we did
2 want to bring forth a few concerns relating to the National
3 Academy's report partially in response to your questions at
4 the briefing by Dr. Frey earlier.

5 The first of those questions is the question of
6 the need for and the contribution of the NRC's subsystem
7 requirements and specifically whether or not the subsystem
8 requirements should be downplayed or eliminated in view of
9 the possibility for sub-optimization as they put it in the
10 report.

11 The second item we thought we might talk some
12 about would be the proper role for the evaluation of human
13 intrusion scenarios and the third one which we have talked
14 about is the proper time frame for the regulatory
15 compliance.

16 Let me explain that we are almost at the same
17 point you are in -- we have had the same briefing, I
18 believe, as I understand it, by Dr. Frey. We have had a
19 short, very short briefing on the few public comments that
20 the EPA has received but no response in terms of what the
21 EPA's determinations might be.

22 At the same time, we are -- we actively commend
23 the fact that the NRC staff has initiated a liaison with the
24 EPA to work with and provide input to the EPA during their
25 standard making process. Quite frankly, we are looking for

1 a meaningful way to interact with the staff on the how-
2 to -- the staff is looking for our input on what their
3 stance should be with regard to some of these issues. We
4 would like to provide that input. At the same time, we
5 don't want to short-circuit our prime responsibility which
6 is to provide advice to you as the Commission.

7 CHAIRMAN JACKSON: So are you saying at this point
8 you don't have an opinion relative to the Academy's finding
9 that NRC's requirements on subsystem performance might sub-
10 optimize the overall design?

11 DR. POMEROY: My feeling on that is that while it
12 may be a legitimate concern to bring up the question of the
13 possibility of sub-optimization, I believe strongly in that
14 earlier defense in depth program and I believe it is
15 important to maintain it. Whether or not it is maintained
16 in precisely the same form as it is now is another question.

17 It could lead to some problems with sub-
18 optimization and this committee feels strongly and has
19 expressed its opinion to you that we believe that we should
20 be looking primarily at the bottom line, at the compliance
21 of the repository and, secondarily, at the defense in depth
22 criteria. I am not sure that everybody at this table, on
23 this side of the table, agrees with me and I wonder whether
24 any people want to offer any comments.

25 DR. GARRICK: Well, I intend to hit this subject a

1 little bit later in reference to the low-level waste
2 performance assessment concept. I think that some of us on
3 the committee believe that the concept of defense in depth
4 is clearly a rational one and an important one. Multiple
5 barriers of protection are very logical from a design
6 standpoint, from a good safety management standpoint.

7 I think where the concern comes is the matter of
8 how much emphasis it gets. I sometimes think that the
9 subsystem requirements get all the attention and that we
10 sometimes take away from the focus being on the bottom line
11 results that we are trying to achieve. My preference on
12 this issue is that we focus very much on the bottom line
13 issue, satisfy ourselves that that is in compliance and back
14 our way into, so to speak, the effectiveness of the defenses
15 that we have provided and hope that they come out in
16 compliance with the regulations.

17 DR. HINZE: We must be concerned about that bottom
18 line but it is of concern to us regarding the stringency of
19 the individual subsystem requirements. Some way or other I
20 think they are going to have to be retained but not
21 necessarily in the stringent form we see them in Part 60 at
22 this time.

23 CHAIRMAN JACKSON: Thank you.

24 DR. POMEROY: I don't know whether you would like
25 to raise further or have further discussion on the question

1 of human intrusion. If not, we would be glad to proceed.
2 If you do, we have --

3 CHAIRMAN JACKSON: Do you have any view on the
4 application of this bore hole intrusion scenario?

5 DR. POMEROY: I think that Dr. Hinze does.

6 DR. HINZE: Well, human intrusion is a vexing
7 problem that is approached in many different ways. It seems
8 to me the first line of defense is right in Part 60
9 regarding the presence of potential natural resources and
10 that has to be the first line of defense.

11 In our February 1993 letter that Paul referred to,
12 we did make some comments regarding this and we did make the
13 comment that we thought that the probability of intrusion
14 was likely to be one over the 10,000 year or 10,000-plus
15 year time frame and so it was a matter of the consequence
16 and that is nothing new or original with us but it is
17 something that we see supported by the National Academy
18 report.

19 The problem is that the National Academy report
20 suggests calculation of the consequences and certainly that
21 can be done but then it drops you off into space and the
22 question is what to be done with it at that point and it
23 seems to me that EPA must deal with that question and they
24 must also consider what the NRC can regulate.

25 There are different approaches to that and they --

1 whether they are included in the CCDF or whether they are
2 just included as information or whether going back to an
3 earlier working draft of 191 dealing with the three-bucket
4 approach and putting the human intrusion into a separate
5 bucket is another possibility.

6 There are a number of things that I think that we
7 have not reached a decision on something we want to reach a
8 decision on but we are still in the thinking and learning
9 stage.

10 CHAIRMAN JACKSON: Thank you.

11 DR. POMEROY: Then we will turn to the second item
12 on our work in progress report, namely the radiological
13 criteria for decommissioning. We have deliberated on this
14 question also for a significant amount of time. We did,
15 however, discuss at our last month meeting the proposed
16 residual decontamination level rule and very specifically
17 out of that, we questioned the applicability of the .15
18 millirem per year standard for residual contamination after
19 decontamination and decommissioning. We urged the NRC to
20 foster government-wide regulation of very low levels of
21 contamination, a subject which, of course, we are all
22 reluctant to face in view of the reception BRC met.

23 We discussed in a letter, an earlier letter, the
24 proposal to apply the 4 millirem standard to water
25 contamination at a site and our concerns most recently are

1 centered on a presentation that was further presented to us
2 this morning regarding the determination of background
3 levels at fuel cycle facilities. Very specifically, how do
4 you look at 15 millirems in the presence of variable,
5 perhaps highly variable, background levels of radiation?
6 And we strongly encouraged at our last meeting an industry
7 offer for an actual pilot demonstration of the efficacy of
8 the proposed rule and research at that meeting agreed to
9 proceed with an attempt to implement that pilot program. We
10 think that would be highly useful in light of the fact that
11 this is a very important problem.

12 We are talking about large quantities of
13 contaminated materials and we are talking about a very
14 expensive remedial effort at low levels of contamination.
15 It is an important problem, we aren't very far along in
16 looking at it in the specific terms of the implementation
17 level.

18 CHAIRMAN JACKSON: But in your April 28 letter,
19 you were talking about radiological standards for low-level
20 waste disposal.

21 DR. POMEROY: That is correct.

22 CHAIRMAN JACKSON: And you felt that 15 millirem
23 is, "an unnecessarily conservative fraction of the 100
24 millirem limitation."

25 Could you elaborate a bit on why you -- and you

1 felt that a limit of 25 to 33 millirem seems more easily
2 justified. Could you elaborate a bit on that?

3 DR. POMEROY: Certainly. I will and I suspect
4 somebody on my left-hand side will also.

5 The 100 millirems is an exposure standard, in
6 essence, as you know. The 15 millirem derives primarily
7 from a conclusion that we can't find much basis for that one
8 should consider the possibility of exposure to seven or six
9 or seven individual, distinct sources and it is a simple
10 division problem, of course, after that.

11 My feeling on that subject is that the question --
12 I think it is unrealistic to think of six or seven
13 simultaneous source exposures. That doesn't mean it is not
14 possible but to me, personally, it doesn't seem realistic
15 and I believe that is a general conclusion that the
16 committee reached in that specific instance.

17 We simply think that perhaps three or four such
18 exposures might be a more reasonable level and that is,
19 essentially, the three or four represents simply a division
20 of that initial 100 millirems into three or four categories.

21 I am sure there are some other comments. Marty?

22 DR. STEINDLER: Nothing particular profound.

23 The factor of three or four is one that seems to
24 be available without specifics however in the international
25 literature. The European Community is currently engaged in

1 trying to make those numbers a little more definitive. That
2 process is proceeding very slowly but, I suspect, will
3 eventually come to a number very close to 25 to 30 millirem.

4 The other issue, of course, which we didn't
5 specifically identify is the issue of cost. The cost
6 benefit for deriving to 15 millirem or below is something
7 that I think that needs to be ultimately factored in. We
8 did hear this morning some technical difficulties voiced to
9 us. That is, simply, detection of 15 millirem above a
10 variable background issue as had been mentioned before, was
11 claimed by the speakers this morning to be either not
12 feasible or impossible. We are not totally convinced at
13 this point that that is correct or cannot be bypassed by
14 relatively inexpensive alternatives but we have not looked
15 at that issue in depth to be able to give you any kind of a
16 hard result.

17 CHAIRMAN JACKSON: Okay.

18 DR. POMEROY: If there is nothing else, may we go
19 on?

20 Our third item relates to our review at your
21 direction of SECY-95-201 that is proposed alternatives to
22 termination of the NRC's low-level waste program. As we
23 have spoken informally with you, we have told you that we
24 want to and are in fact reviewing this SECY document in the
25 broadest possible sense. That is, we are trying to look at

1 the entire low-level waste program of the Agency and we are
2 trying to look at the question of what should the NRC's role
3 be in the low-level waste program.

4 Present status on this is that we have had a
5 presentation by the NMSS staff and by the Nuclear Energy
6 Institute and this morning we have had a marathon session
7 with representatives of the Office of State Programs,
8 Department of Energy National Low-Level Waste Management
9 Program, Nebraska, New York State. Again, we talked with
10 Fuel Cycle Facilities Forum this morning and we have talked
11 with the Chair of the E-5 Committee of the National
12 Conference of Radiation Control Program Directors. And we
13 also have a large number of letters that some of them have
14 been addressed to you, some of them have been addressed to
15 me, some of them have been addressed, I believe, to the
16 staff and with regard to this issue.

17 It certainly inspires a great deal of discussion
18 at places like the Low-Level Waste Forum and the Agreement
19 States Conference that Dr. Steindler attended several days
20 ago. We don't have conclusions for you at this point in
21 time.

22 We are, however, looking at the impact of the
23 various options on the effective monitoring of the Agreement
24 States program, the impact on a redistribution of personnel
25 resources and the effect on the Agency's public health and

1 safety responsibilities. We feel that that is a question
2 that is not at least specifically addressed in a very strong
3 way in SECY-95-201, although it may constitute the
4 background for that document.

5 We also want to investigate the impact of
6 discontinuing the research activities that are contemplated
7 to be stopped as a result of this and we are concerned and
8 we feel that it is an appropriate concern for the Commission
9 about the possibility for regulatory fragmentation. That
10 is, if we don't serve, we the Nuclear Regulatory Commission,
11 I assume we count as part of that, that if we don't assume
12 the regulatory role, the Department of the Interior, other
13 departments at the federal level, the states, other people
14 will have to fill part of that if not a lot of that gap and
15 we feel fairly strongly that I think, although I can't speak
16 for everybody here, that there should be a central federal
17 entity that controls essentially in some way the application
18 of all of our low-level waste standards and not have it be
19 de facto assumed by other government agencies, for example,
20 or state agencies.

21 CHAIRMAN JACKSON: What do you think would be the
22 health and safety impact?

23 DR. POMEROY: It seems to me that there could be a
24 broad spectrum of possible impacts that might end up as
25 public health and safety issues. For example, questions

1 that we don't perhaps address even appropriately now but,
2 nevertheless, questions of medical maladministration, if
3 there were little or no effective monitoring of that kind of
4 a program by something like the Nuclear Regulatory
5 Commission, there are other effects that are not public
6 health and safety but are significant economic issues and I
7 would like to just mention that one of those two because we
8 have expressed very strongly to you questions about the bag
9 house dust issue. That is not, I don't believe, a direct
10 public health and safety issue but, nevertheless, it is an
11 issue that is worth millions of dollars to a number of
12 important elements in our country's economy.

13 One should be very concerned about the proper
14 administration and location of those sealed sources that
15 ultimately end up in the scrap chain. That doesn't seem to
16 happen to us. That doesn't seem to be carried out in a
17 completely effective manner at this time.

18 DR. STEINDLER: Let me just make a comment.

19 DR. POMEROY: Yes.

20 DR. STEINDLER: The direct health and safety
21 impact would probably be a little more difficult to
22 ascertain in a numerical fashion but the concerns that I
23 think that we have surfaced so far is if the Nuclear
24 Regulatory Commission cuts down its effort or reduces it
25 sharply. The quality of the licensing evaluation and those

1 areas particularly that are not Agreement States, of which
2 there are several, that currently have in process the
3 license application or the evaluation of sites from low-
4 level waste disposal facilities, they will turn out to be
5 less than the kind of quality that the NRC would ordinarily
6 tolerate in its approach.

7 It is hard to see that that is going to be of any
8 kind of great benefit and could, in fact, in the long haul,
9 represent a significant detriment. Recognizing that
10 speculation, of course, depends a great deal on the details
11 and the protocol of how that is handled inside the Agency.
12 But, in the absence of specific information in 95-201, we at
13 least have to postulate that that is a potential that we
14 have to be concerned about.

15 There are other impacts and that is if in fact the
16 public view of the licensing process deteriorates and,
17 hence, the number of licenses that are successfully pursued
18 to a conclusion of a facility, that will easily and has
19 already in fact led to a pile-up of low-level waste in areas
20 where you are at the moment storing them. That is not a
21 disposal issue; it is an issue of management of low-level
22 waste, but that is also not to the benefit of the public at
23 large.

24 It allows simply increased opportunities for
25 health and safety difficulties that are remediable to be

1 sure but are probably unnecessary. We have to trade that
2 off against whatever the economic issues are that drive 95-
3 201 toward one of the other of the options that have been
4 proposed.

5 DR. GARRICK: Yes, I want to just give a little
6 spin on that. Dr. Steindler uses the word "quality" by
7 which he means a lot of things including technical depth and
8 understanding. One of the things that has been observed by
9 all the letters and by all the presentations is the value of
10 the NRC as a source of expertise, as a source of technical
11 knowledge.

12 Of course, there is recognition that that
13 capability is greatly stimulated by the fact that they have
14 been deeply involved in the regulatory process and in the
15 implementation of such a process and as that aspect of the
16 business diminishes, surely so will the level of expertise
17 which all are saying is an extremely important and valuable
18 asset to the health and safety issue.

19 CHAIRMAN JACKSON: Thank you.

20 DR. POMEROY: There are two things that I would
21 like to add and one is that the letters and the
22 presentations to us have indicated that there is a broad
23 spectrum of opinion clearly out there with regard to what
24 should happen to the low-level waste program. I don't think
25 anybody, with one possible exception, has advocated the

1 complete abolition of the termination of the program. But
2 people have indicated an unhappiness with the specific
3 Option 2 you have been offered and some people have
4 indicated an unhappiness with Option 1, in fact, indicating
5 that they would like to see a greater effort placed in the
6 low-level waste program.

7 This merely indicates to us that it is going to be
8 a more complex problem to try to look at some representative
9 view of the various stakeholders involved here and we are
10 still trying to meet the 12/29/95 deadline and expect to do
11 so at this point.

12 If there are no other comments?

13 DR. HINZE: Well, I was going to add not only is
14 there the concern with the technical assessment and the TA
15 work in general but also with the research. The research,
16 the low-level research is deemed to have been very
17 successful, been useful in terms of health and safety of
18 this nation and there certainly are good and valid reasons
19 as we have been hearing for continuing a certain level of
20 that type of research.

21 DR. POMEROY: The final issue that is a work in
22 progress relates to our high-priority issues with regard to
23 low-level waste. We have provided copies of these issues,
24 what we consider the highest priority issues that we have
25 determined. This list of issues as you may remember we

1 developed at a September retreat. We started with some 150
2 issues in low-level waste and ended up -- low-level and
3 high-level waste and performance assessment and ended up
4 with the 11 issues that are on the slides that you have and
5 also on the list that you have.

6 So in some sense we were, at least, in the
7 forefront of your re-baselining, reexamination program on
8 the ways in which we are going to focus our activities in
9 the future. These are high-priority issues, although they
10 are only a few months old, of course, and have been
11 overtaken by events and by the current response activities
12 of the Commission staff and I would like to, if I may, just
13 briefly run through these simply as a list and indicate
14 which ones of those obviously need to be reexamined.

15 The regulatory framework includes, of course, the
16 National Research Council National Academy of Sciences
17 report on the technical bases for the Yucca Mountain
18 standard and, indeed, that is clearly an important item on
19 your agenda and it remains one for us also.

20 The adequacy of the program approach. Well, the
21 program approach itself doesn't exist anymore as we
22 understand it. Whatever processes are used for site
23 characterization in general and Yucca Mountain in particular
24 might continue to be and will continue to be an important
25 issue almost regardless of what happens, unless there is no

1 licensing activity whatsoever.

2 Technical site suitability itself, if you think of
3 the initials, the TSS initials and the program for technical
4 site suitability, that apparently has also at least been
5 placed on hold but that almost involves all of the science
6 involved in site characterization and that is going to be an
7 important part of any repository activity that we are
8 involved with in the future.

9 Repository, similarly, with repository thermal
10 loading and coupled processes and the models.

11 License application review plan. It is also
12 apparently at least in a hold pattern if not been
13 eliminated. Nevertheless, the NRC staff's repository
14 licensing strategy remains an interesting and high-priority
15 topic for this committee.

16 And, again, the two-stage licensing process.

17 Turning to low-level waste issues --

18 CHAIRMAN JACKSON: Before you do that?

19 DR. POMEROY: Sure.

20 CHAIRMAN JACKSON: You gave a review of the
21 hydrology program and in it you made the point that the
22 staff should pay particular attention to new research needs
23 that might come out of the National Academy study. Have
24 there been any that you have identified or that you would
25 foresee?

1 DR. POMEROY: I can answer that but Dr. Hinze is
2 our expert in that area.

3 DR. HINZE: Well, there are things that are
4 obvious that have been talked about and this includes a
5 greater emphasis upon the saturated zone as part of the dose
6 standard. There is also, we did look at sufficiency and we
7 also felt that one of the things that needed to have greater
8 emphasis was the movement of water through faults. This is
9 a good way to concentrate the flow of water in the
10 subsurface, particularly in the unsaturated zone, yet there
11 seem to be differences of opinion and different results in
12 terms of the fault permeability. These are just a couple of
13 examples of the kinds of things that have to be looked at.

14 The staff in the vertical slice studies are
15 looking very closely at the research needs as they develop
16 and we hope to be looking at those with them.

17 CHAIRMAN JACKSON: Thank you.

18 DR. STEINDLER: let me make a comment if you don't
19 mind.

20 The risk approach that the National Academy is
21 advocating is qualitatively different than the release table
22 that exists and the qualitative difference comes in the
23 potential for using dilution as a method of coming to a
24 particular risk. Dilution has historically been a forbidden
25 methodology for the disposal of waste as a matter, I

1 suppose, of national policy.

2 The consequence of that possibility not only comes
3 back to some fairly stringent requirements on changing Part
4 60 and sharpening regulations to be in accord if that policy
5 is maintained with that policy but, as Bill pointed out,
6 really makes the behavior of nuclide transport in the
7 saturated zone a very important issue and it is pretty
8 obvious that research areas in that domain are going to have
9 to be carefully pursued, for what that's worth.

10 CHAIRMAN JACKSON: Thank you.

11 DR. POMEROY: Turning to what we consider to be
12 the high-priority issues in the low-level waste area, the
13 first and clearly the highest priority that we assigned in
14 the low-level waste area, and remembering that this was in
15 September before we had seen SECY-95-201, was the role of
16 the NRC and secondarily the Advisory Committee on Nuclear
17 Waste in the total low-level waste process. What should the
18 role of the NRC be? Therefore, SECY-95-201 timing was
19 excellent from our standpoint because it provides us a
20 vehicle for evaluating and carrying out an evaluation of the
21 low-level waste program.

22 The other two items under low-level waste involve
23 the use of risk-based regulation and clearly there is a
24 shift from deterministic regulations, we think, toward risk-
25 based regulations or at least the suggestion that that be

1 done. the third item is the role of the ACNW in terms of
2 decommissioning activities.

3 There are also two issues:

4 CHAIRMAN JACKSON: Let me ask you a question.

5 DR. POMEROY: Surely.

6 CHAIRMAN JACKSON: You talked about risk-based
7 regulation. You are just getting started, you are saying,
8 in looking at this. So do you have any preliminary comments
9 about risk assessments and their role in low-level waste
10 performance assessments?

11 DR. POMEROY: The man on my right is dying to --

12 CHAIRMAN JACKSON: That is why I asked. I didn't
13 want him to die.

14 [Laughter.]

15 DR. GARRICK: I will address this in a little
16 while.

17 CHAIRMAN JACKSON: As part of your remarks?

18 DR. GARRICK: Yes, as part of my remarks.

19 CHAIRMAN JACKSON: All right, fine, I will wait
20 with baited breath.

21 DR. GARRICK: But the answer is, yes, yes, yes,
22 yes.

23 DR. POMEROY: And that may be the shortest answer.

24 DR. HINZE: And he did that sitting down.

25 [Laughter.]

1 DR. POMEROY: There are, however, two what we
2 consider to be high-priority issues in the area of
3 performance assessment as well, the first of them being the
4 whole question of how we treat the uncertainty in
5 compounding analyses and, secondly, the continuing saga of
6 the role of expert judgment as it enters into the licensing
7 process. We are very clear of how it enters into the
8 scientific process.

9 It is less clear to us how to create an effective
10 link of that important segment of information to the
11 licensing process. Of course, the staff is actively working
12 on this as well and we have had a long-term interest in that
13 and will continue to investigate that and bring it to you
14 periodically.

15 Those essentially are the four areas that
16 constitute a progress report of work in progress. We do
17 actively, as we have said, solicit inputs from you with
18 regard to the issues and we hope you will simply disregard
19 those issues that have been overtaken by circumstance and if
20 there are no other questions in regard to the work in
21 progress we then want to turn to what we probably consider
22 to be a more traditional approach to this briefing and turn
23 the briefing over to Dr. Steindler, on my left, to talk
24 about the lesson learned at Ward Valley that was contained
25 in a report to you dated the 10th of August, 1995.

1 COMMISSIONER ROGERS: I wonder just before you do
2 that, I wonder if you could just say a little bit about
3 where you think you stand on the role of expert judgment. I
4 know you have been working on this for some time now and I
5 am just curious as to how close to closure on that have you
6 come?

7 DR. POMEROY: I think we are, in terms of the
8 committee, we are very close. We are, in fact, I think,
9 almost in a closure situation in the sense that we believe
10 strongly in the use of expert judgment, we believe strongly
11 in the formalized expert elicitation process and we are --
12 our current problems are simply ones of how do we
13 incorporate that.

14 We expect that if there were a licensing
15 application for a high-level waste repository, that we would
16 see a number of expert elicitations contained in that
17 license application, formal, expert documented, expert
18 elicitations. We would expect that there would be probably
19 independent evaluations, the same kind of formal
20 elicitations sponsored by the NRC staff that would also be
21 presented as part of the application procedure. And we
22 clearly expect that there would be a number of intervenor
23 formal elicitations of expert judgment as well.

24 The questions that bother us are ones of the legal
25 admissibility of these expert elicitations which we believe

1 are going to be a significant factor in the decisionmaking,
2 the final decisionmaking process. We are concerned about
3 the legal admissibility of these into the licensing
4 hearings.

5 COMMISSIONER ROGERS: Well, it would seem to me
6 that that is something you might dodge. I mean, I think the
7 value of your thoughts on this are going to be based on your
8 technical expertise, what you have to say about how to deal
9 with a technical area where there is not a sufficient --
10 there are not sufficient data to really come to a hard,
11 clear, unambiguous scientific decision and yet there is a
12 lot of knowledge that exists that should be brought to bear
13 on the subject and it would seem to me that what would be of
14 most value to us would be for you to try to focus very
15 sharply on how to corral that information and get it
16 together in some way from the best scientific and technical
17 point of view and the legal ballet that may have to go on to
18 use this is something that would seem to me it is best for
19 you to avoid.

20 DR. POMEROY: I'd like to disagree with you a
21 little bit if I might. I know that is not customary to do
22 that here. It is certainly true that --

23 COMMISSIONER ROGERS: It should happen.

24 CHAIRMAN JACKSON: ' Once every two or three years.

25 [Laughter.]

1 DR. POMEROY: And this is it.

2 I do agree with the part of your statement that
3 indicates that it certainly should be our prime focus to
4 look at the clear delineation and proper documentation of
5 the science involved. Certainly that is true.

6 I guess that what I am concerned about is that we
7 can do that but if it is not going to be allowed into the
8 decisionmaking process, then there is something that is very
9 fundamental that needs to be looked at and it is a science
10 concern because what we are saying is we are not going to
11 admit a body of evidence that has value because of legal
12 constraints involved.

13 CHAIRMAN JACKSON: Well, I think the point,
14 though, that is kind of an addendum to what Commissioner
15 Rogers had to say is that in the process of trying to do
16 what he suggested, you in effect are delineating areas where
17 there is going to be gaps and where -- and that, in fact, is
18 the value of what you can do to say where, from a scientific
19 or technical base, you know, there are places where perhaps
20 that can only be dealt with in this way and then a decision
21 has to be made. But that is not a decision that you have to
22 worry about; it more has to do with delineating where, in
23 fact, the technical issues are that can only be dealt with
24 in a particular way and where expert judgment can be most
25 efficaciously used. Then the legal piece has to play out.

1 DR. POMEROY: Right. There is perhaps one other
2 aspect that is namely we have advocated that one can foresee
3 endless arguments about the methodology by which the
4 scientific information is brought together and we have
5 advocated in the past and continued to advocate, I believe,
6 as a committee some rulemaking device to take the question
7 of methodology of expert elicitation out of the licensing
8 arena and place it in an arena at an earlier point of time
9 where we can discuss it and perhaps reach -- get to the
10 point where we have eliminated that source of contention
11 from the licensing process.

12 I certainly agree that our primary emphasis should
13 be on looking at the science involved.

14 COMMISSIONER ROGERS: Well, just, you know, I
15 think we have talked about this subject before but just
16 how -- there are different levels of knowledge and yet the
17 fact that one hasn't achieved the highest level of
18 enlightenment doesn't mean that you don't know anything or
19 you can't make a decision. But I think being very clear on
20 what those are and to what extent a professional community
21 has more or less come to some reasonable position on
22 something, that still doesn't have all of the foundations
23 that you would like to have in the way of support from basic
24 research results and so on and so forth.

25 DR. POMEROY: Right.

1 COMMISSIONER ROGERS: And I think that is very
2 helpful to be able to indicate what that hierarchy of
3 knowledge and confidence is, even though you may not have
4 everything that one would really like to have for a full
5 scientific exposition of knowledge in the subject.

6 I think that to be able to indicate that kind of
7 hierarchy and the extent to which professionals can more or
8 less agree, even though they don't have everything that is
9 necessary there, does not mean that that is not without
10 considerable value.

11 But then when you try to, you know, second guess
12 how it is going to be admitted on a legal basis, it seems to
13 me you get yourself into a morass that isn't easy to do
14 anything very useful. I think as professionals, you have a
15 lot to contribute. But if you want to start worrying about
16 whether it is legal or not, then you are going to have to
17 get the lawyers in that and then it is a different kind of
18 activity.

19 So I, you know, I think we have talked about this
20 before and maybe disagreed a little bit on it but I do think
21 that you can make a very valuable contribution if you kind
22 of stick to it from a purely professional's point of view
23 and your professional point of view and let the lawyers get
24 into it when they have to.

25 DR. POMEROY: We are looking at it from one other

1 viewpoint also, of course, and that is that the NRC staff is
2 currently developed a branch technical position on the
3 formal elicitation of expert judgment and we are reviewing
4 that branch technical position as it is being developed and
5 providing input to the staff.

6 It is also our thought, of course, and one of the
7 driving factors to us is that there are currently major and
8 expensive elicitations being carried out by the Department
9 of Energy. It seemed to us that if the NRC structured is
10 not going to allow that kind of study to be admitted, that
11 that should be communicated quickly and effectively by the
12 NRC staff through the Department of Energy because certainly
13 none of us want to utilize major amounts of resources on
14 something that may not be possible to incorporate into the
15 licensing process.

16 CHAIRMAN JACKSON: Why don't you go on?

17 DR. POMEROY: Thank you.

18 Now, we will turn to Dr. Steindler and the lesson
19 learned at Ward Valley.

20 DR. STEINDLER: I think this discussion could be
21 relatively short. We have been, over the past year or two,
22 looking hard at the performance of the licensing bodies as
23 site characterization for various potential sites have come
24 up in states. We have heard from Illinois and we have
25 examined the Illinois process, we have read the report, we

1 have heard from both members of the Commission as well as
2 participants in the fairly long hearing, contentious and
3 prolonged hearing.

4 We have had our members go to the California Ward
5 Valley hearing and looked hard at that. We have read the
6 National Academy report on Ward Valley. We have had folks
7 from Texas and Nebraska and other states come to us and tell
8 us about what it is they are doing, what kind of problems
9 they have had, where they have been successful and, at
10 times, where they have not been successful.

11 As we reviewed, in the low-level context, what it
12 is we were hearing, it was pretty obvious that there were
13 some things we could learn from that process which, clearly,
14 the states as they have talked among themselves have learned
15 but perhaps it was worthwhile highlighting that.

16 We summarized some of those common threads in our
17 report which, in effect, said that one of the outstanding
18 things that we keep hearing and this was stimulated by some
19 explicit comments in the National Academy report, one of the
20 things that was clear and came through in most of the things
21 that we have heard is that there is a need for technical
22 expertise in the site qualification investigations and the
23 site qualification investigations, because they tend to be
24 adjudicatory, are strongly dependent on the quality of
25 material that is ultimately obtained both in the quality

1 assurance area as well as the general quality of the
2 scientific investigations.

3 It also became apparent that some states or some
4 applicants that are generating information for the site seem
5 to be unfamiliar with how rigorous the licensing process
6 demands are in terms of the quality of the material that
7 they have to present, even though NUREG 1200, the standard
8 review plan, exists and is available and most people know
9 about it.

10 The other point seemed pretty obvious, that the
11 establishment of what we call a robust peer review process
12 is not generally known and has been often poorly practiced
13 because the review process, except in areas that are outside
14 the nuclear domain, has not been widely practiced at least
15 in this area. To be sure, in the reactor area they have but
16 not in the waste management business.

17 This experience led us to conclude that, in
18 several instances, it seemed pretty obvious that peer review
19 panels would have made an enormously important contribution
20 to moving the ball forward and avoiding what turned out to
21 be really quite unnecessary conflicts and adjudications and
22 time schedules and wastes of energy and resources.

23 We thought that the review panels could ensure a
24 certainly thorough and defensible coverage of the technical
25 issues, not the political or the economic but the technical

1 issues that are needed to be addressed in describing the
2 quality of a site when the site question arises. Adequacy
3 and sufficiency of data collection, the planning of the
4 actual process of going out and getting data, the analysis
5 and how it is done and, of course, the quality of the
6 conclusions.

7 The Martinsville site, for example, in Illinois,
8 the Commission was extremely critical of the quality of the
9 information that was laid before them as being sufficient to
10 make a decision about the site. We felt that a peer panel
11 to track that and, to some extent, maintain both cognizance
12 over what is going on but also the help and planning and
13 assuring the quality would have made an enormous difference.

14 Finally, in many instances, panels of that kind
15 lend credibility to the final outcome which, in many cases
16 that we have seen was missing.

17 We therefore suggested in a letter that,
18 unfortunately, was misunderstood by some of the readers,
19 that the role of the NRC staff would be to provide generic
20 planning help to those states or generally the states to
21 formulate and how to formulate and how to conduct oversight
22 reviews. We suggested that the NRC staff provide some plans
23 for those people who were either interested in doing that
24 or, in the case of Illinois and some other states have
25 learned the hard way that such attention to detail in the

1 site characterization was necessary. So we basically said
2 that we thought that that was a function of the NRC since no
3 one else could do the centralized planning and, besides, the
4 NRC low-level program does now have a significant level of
5 experience that they can call on knowing what the various
6 states have done.

7 The response that we have gotten from various
8 people have been mixed. I think the states in general that
9 we have talked to, which have been very informal and hardly
10 in depth, have generally felt that such guidance would have
11 helped. The staff was not particularly enthusiastic, being
12 already overworked and looking at 95-201, said you are
13 moving in the wrong direction, since we are trying to shed
14 responsibility rather than increase it.

15 Nevertheless, because of the difficulties that
16 people have just getting through the site characterization
17 process. We feel that peer reviews moving, guiding and
18 helping the general process of site characterization would
19 make a significant difference.

20 That was our message, fairly simple, nothing
21 particularly complex. We simply felt that the staff was
22 able to, because of its experience, put together a set of
23 guidance, as they do in many other areas on how to do this,
24 when to do it, what kind of activities could be involved,
25 how to pick panels in generic terms and then let the states

1 adopt that to whatever their specific situations are.

2 We heard today from Nebraska, for example, on
3 95-201 and the folks in Nebraska pointed out that they have
4 a very small in-house staff but they use a large number of
5 people, they mentioned something over 100, made up into
6 various panels to guide the various programs and help them
7 out. Well, clearly, they don't need much help. But other
8 states, you know, we can judge from experience, do need some
9 help. That was basically our message.

10 CHAIRMAN JACKSON: Thank you.

11 DR. POMEROY: We now, Madam Chairman, 18 minutes
12 left. I would like to serve as a gatekeeper here to provide
13 what would be of most interest to you. We have two
14 presentations left, one on the hydrology research program
15 and groundwater travel time reports dated 5/25/95 and
16 11/6/95 and Dr. Garrick, who was going to speak on the
17 letter that we wrote to you on regulatory issues in low-
18 level waste performance assessments, a risk perspective, and
19 I would like to add we can divide that time up between the
20 two of those presentations or, if you want to discuss risk-
21 based regulation, we could just simply do that in the time
22 remaining.

23 CHAIRMAN JACKSON: Why don't you hit the high
24 points and the conclusions on hydrology in five minutes and
25 then spend the rest of the time.

1 DR. POMEROY: Go, bill.

2 DR. HINZE: You're asking a professor to summarize
3 in five minutes.

4 [Laughter.]

5 CHAIRMAN JACKSON: But a professor asked you to do
6 that.

7 DR. HINZE: I will do my best.

8 Actually, this is part of a continuing program
9 that we have in hydrology overview and the slides 19 and 20,
10 pages 19 and 20, do provide you with that overview.

11 It is the position of our committee that hydrology
12 research which is focused on these licensing needs are
13 important and the reasons for that are quite clear there.

14 Despite this good news there, we do have some
15 recommendations regarding the relevancy, sufficiency and
16 timeliness. Many of these, in the generic sense, are a
17 carryover of our letter of 1994, mid-1994, on vulcanism
18 analogues and tectonics. The bottom line to it is that we
19 would like to see the program, the research programs in both
20 the center and the University of Arizona, which are very
21 good programs, we would like to see them be focused more on
22 a risk-based approach, have a firmer root in looking at
23 consequences and uncertainties and looking at this through
24 performance assessment and feeding that back into
25 performance assessment.

1 There is also a need, I think, for the Office of
2 Nuclear Regulatory Research to, in a very timely way, do
3 some translation of some of these more esoteric results, if
4 you will, into very practical licensing needs and concerns
5 for the Commission staff.

6 That is very brief, but I also should say that we
7 did spend some time working with various groups regarding
8 the groundwater travel time issue. That, in a way, has been
9 superseded by the events but it is clear that groundwater
10 travel time, in one way or the other, still needs to be of
11 concern because in writing Part 60, the subsystem
12 requirement on groundwater travel time, that really was put
13 in there, as we understand it, as a surrogate for the
14 integrity of the site to the containment of fluids and that,
15 in some way or other, is still going to have to remain and,
16 in some way or other, it has to be modulated by flux
17 concerns. So it isn't just the fastest molecule but
18 involves the flux as well.

19 My colleagues can, perhaps, if I have missed
20 some --

21 CHAIRMAN JACKSON: Is it fair to say that, as I
22 look through it, that Viewgraphs 21 and 26, which I think
23 was up there, in some ways capture the essential points with
24 page 21 referring not just to the Office of Nuclear
25 Regulatory Research but, in a certain sense, to the center

1 as well as the University of Arizona.

2 DR. HINZE: That is quite correct. Excellent.

3 CHAIRMAN JACKSON: That is the message I think you
4 want to give.

5 DR. HINZE: Right.

6 CHAIRMAN JACKSON: Very good. Thank you.

7 DR. POMEROY: All right, John, will you try to do
8 the same in approximately five or six minutes?

9 DR. GARRICK: Yes, I will, and I will finish in
10 the allowed time and that may surprise my colleagues, but I
11 will.

12 What I have been asked to do is to talk about the
13 specific letter having to do with regulatory issues in low-
14 level radioactive waste disposal performance assessment but
15 to give some emphasis in the discussion of that letter to
16 what we have been doing as a committee with respect to
17 performance assessment in trying to bring more and more
18 attention to the risk-based thought process in carrying out
19 of such assessments, I think that one of the valuable
20 services that advisory committees can provide and I know,
21 certainly, that the ACRS has been doing this, is to assist
22 and stimulate the movement toward new methods and new ways
23 of doing things.

24 So I think it is very appropriate for us, as a
25 committee, given that the NRC has made a commitment to

1 increase its use of probabilistic thinking, I think it is
2 very appropriate for us to show some vision and some
3 capability on how that is done. So I think that the PRA
4 policy statement that was issued in August of this year was
5 a major step forward because it was the first time that
6 there was, indeed, a commitment to increase the use of
7 probabilistic methods in the regulatory process, even though
8 there has been the IPE program and the IPEEE before it and
9 that risk assessments have been around for a long, long
10 time. So I think that is an important milestone.

11 I think also the matter of risk-based thinking is
12 very important to the question of relevancy. Context
13 perspective is always something we are struggling with when
14 we are trying to demonstrate compliance, when we are trying
15 to arrive at a bottom line with respect to reasonable
16 assurance of safety to the public.

17 I think also it is very important for us to
18 realize that risk assessment does not necessarily mean large
19 and elaborate models and efforts beyond what can be expected
20 of people. There can be simpler models, simply if you
21 embrace the notions of uncertainty analysis and recognize
22 that when you employ simpler models, you have to acknowledge
23 that in the fact that your parameter calculations are
24 probably with greater uncertainty. But that is one way of
25 acknowledging it and it is a very effective way of

1 acknowledging it.

2 So I think that the regulations, while 10 CFR Part
3 61, for example, is certainly not risk-based or
4 probabilistic, there is language in that regulation that
5 suggests it is a logical extension. There is language about
6 selecting pathways, there is language about identifying or
7 determining the likelihood of events and accidents, there is
8 language about the assessment of expected exposures and so
9 forth.

10 The branch technical position is taking the first
11 extension of that language and building on it, even though
12 it has not been finalized yet, to embrace some of these
13 concepts even moreso.

14 So what are we talking about here? When we do a
15 risk assessment and we ask ourselves what is the risk, we
16 are really asking three questions and the questions are,
17 what is -- what can go wrong, how likely is it and what are
18 the consequences. Now the regulations certainly address the
19 question of what can go wrong and the regulations certainly
20 deal with the question of what are the consequences. So the
21 main feature we are trying to bring to the table here is the
22 feature of dealing with the question of perspective, the
23 question of relevancy and the question of likelihood.

24 So in this letter, we had to address four
25 particular issues that had been put before us by the NRC and

1 I think that, rather than getting into them one at a time,
2 what I will do is just try to highlight them and jump to
3 slide number 33 and see if we can do this in the next three
4 or four minutes.

5 Most of the letter was inspired by an NRC staff
6 briefing in low-level waste regulatory issues that took
7 place in March of 1995 and the staff shared with us what
8 they considered to be the four questions or the four issues
9 that they wanted to have some input on.

10 Those four issues were, number one, consideration
11 of site conditions, processes and events in performance
12 assessment; number two, the performance of engineered
13 barriers; number three, the time frame for performance
14 assessment, and; number four, the treatment of sensitivity
15 and uncertainty in low-level waste performance assessment.

16 Now, overall, it was the conclusion of the
17 committee that we generally supported the staff's approach.
18 We did have some concerns about the interpretation and
19 implementation of probabilistic methodology for performance
20 assessment. We did feel that, as I spoke to earlier, that
21 maybe there should be more focus on bottom line safety
22 performance measures and not quite so much focus on
23 subsystem performance measures. For example, recognizing,
24 however, that in the end we have certainly got to satisfy
25 those requirements. But the thought here is that there is

1 much to be gained early on in the process. If you attempt
2 in the spirit of the method of successive approximation to
3 get a first or zero thought or answer to the performance
4 measures that you will ultimately have to satisfy.

5 So we did discuss that quite a bit with the staff
6 and we did recommend that they be more focused on those kind
7 of performance measures. There was a lot of conversation
8 about the defense in depth philosophy. There is no question
9 that it is a sound philosophy that safety barriers are
10 critically important. But I think it is also very important
11 for us to make those barriers as effective as we can in
12 terms of their contribution to the safety. That is to say,
13 to be as knowledgeable as we possibly can about how
14 effective they are.

15 I think, for example, there are many places where
16 we applied risk assessment methods in the past that we
17 realized major breakthroughs with respect to the
18 effectiveness of different lines of defense. When we first
19 did the comprehensive risk assessments in nuclear power
20 plants and discovered that for some of the containment
21 systems we were looking at, the capacity of the containments
22 were anywhere from three to four times the design values,
23 that was very reassuring. It was very important for us to
24 begin to calibrate these lines of defense in such a way that
25 we could make tradeoffs and that we could cm closer to

1 optimizing that.

2 So I think those people in this business that push
3 for looking at the bottom line and justifying that are not
4 suggesting that the subsystems should not be an important
5 element of the whole process of assuring safety but that,
6 rather, we should try our best to determine how valuable and
7 how effective they are so that we can move in the direction
8 of optimization.

9 So with respect to things like the engineered
10 systems, I think that the other thing we were saying is that
11 we think that if we are going to the effort of providing an
12 engineered barrier, the mechanism ought to exist if we can
13 convince people of the value of that engineered barrier,
14 that credit can be given for that. So we cautioned the
15 staff on putting too much emphasis on arbitrary time frames
16 like 500 years you will get credit for the capability of
17 your waste package but after 500 years we won't allow
18 credit.

19 I think the risk-based perspective, the
20 probabilistic perspective, suggests that that isn't quite
21 the way it works. It may, in fact, not be good past 100
22 years but, on the other hand, if the evidence is
23 overpowering that it is good for 800 years or 1,000 years,
24 the regulations in a risk-based sense ought to accommodate
25 that.

1 So, in a sense, our letter was using this as an
2 opportunity to push the risk-based idea in a process that
3 was in place. We all have heard the NRC say that the best
4 way for the risk-based regulatory process to begin to take
5 place is with pilot applications. Now, in the reactor
6 field, there is much greater opportunity for pilot
7 applications than there are in the waste field but the
8 performance assessment is clearly one very valuable
9 opportunity and to the extent that it can be done and not be
10 disruptive and can be gradually moved into the normal
11 process, then you will probably find our letters more and
12 more pushing in that direction.

13 CHAIRMAN JACKSON: And so these remarks of yours,
14 I take it, go beyond low-level waste?

15 DR. GARRICK: Yes. Yes, they do.

16 CHAIRMAN JACKSON: I prefer risk-informed.

17 DR. GARRICK: I have heard that.

18 [Laughter.]

19 DR. POMEROY: I think that completes our planned
20 presentation for this afternoon, Madam Chairman.

21 COMMISSIONER ROGERS: Just starting with the last
22 comments, it does seem that your thoughts and emphasis on
23 the value of a risk analysis, even if it isn't a totally
24 complete model to work with, still has enormous value as a
25 starting point for understanding and development and further

1 development. And I think that is something that is probably
2 going to be a very relevant point of view with respect to
3 the high-level waste program in the future.

4 DR. GARRICK: Yes.

5 COMMISSIONER ROGERS: As DOE has to reevaluate how
6 it approaches the whole question of carrying out its
7 responsibilities with respect to Yucca Mountain, it may very
8 well be that adopting your point of view there early on will
9 be important to be able to make some progress.

10 DR. GARRICK: We hope to be able to report on that
11 to you at a later meeting, too.

12 COMMISSIONER ROGERS: Good, because I think that
13 will be very valuable.

14 I would just thank the committee once again for
15 their efforts. I do think that it is important to try to
16 take a new look at what you do because, as we move forward
17 with a different focus of our activities in the waste area
18 forced upon us by budgetary constraints, that it may be
19 important to try to decide, once again, what really are the
20 most important things to be looking at.

21 CHAIRMAN JACKSON: Thank you, Dr. Pomeroy and
22 other members of the committee, Dr. Hinze, Dr. Garrick,
23 Dr. Steindler and Dr. Larkins, for a very full and
24 productive meeting. It is clear this whole area of nuclear
25 waste is one that is not going away and it is one that your

1 input is very valuable to us on and we look forward to
2 continuing to receive sound advice and especially with
3 respect to some of the insights, Dr. Garrick, you and
4 Dr. Hinze brought to the fore with respect to a risk-
5 informed approach, as Dr. Rogers spoke to, particularly as
6 to how it flows into doing overall system performance
7 assessments and using that to bound and guide what work is
8 done.

9 So, again, thank you very much.

10 DR. GARRICK: Thank you.

11 [Whereupon, at 3:32 p.m., the briefing was
12 concluded.]

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CERTIFICATE

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

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

PLACE OF MEETING: Rockville, Maryland

DATE OF MEETING: Thursday, November 16, 1995

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

Transcriber: Christopher Fitchell

Reporter: Mark Mahoney

**ACNW BRIEFING FOR THE
COMMISSION
NOVEMBER 16, 1995**

ACNW REVIEWS IN PROGRESS

**Dr. Paul W. Pomeroy
Commission Briefing
November 16, 1995**

INTRODUCTION

SPEAKING TOPICS:

- **STATUS REPORT ON WORK IN PROGRESS --**
 - (A) NAS REPORT ON YUCCA MOUNTAIN STANDARDS**
 - (B) RESIDUAL LEVELS OF CONTAMINATION**
 - (C) NRC'S LLW PROGRAM OPTIONS--SECY-95-201**
 - (D) ACNW PRIORITIES**
- **LESSONS LEARNED FROM THE WARD VALLEY LLW SITING PROCESS (REPORT DATED 8/10/95)**

- **HLW RESEARCH IN HYDROLOGY (REPORT DATED 11/6/95) AND GROUNDWATER TRAVEL TIME (REPORT DATED 5/25/95)**
- **REGULATORY ISSUES IN LLW PA (REPORT DATED 6/28/95)**

NAS REPORT TECHNICAL BASES FOR YUCCA MOUNTAIN

Questions in (Energy Policy Act of 1992)

Y "(A) Whether a health-based standard based upon doses to individual members of the public from releases to the accessible environment (as that term is defined in the regulations contained in Subpart B of Part 191 of Title 40, 1985) will provide a reasonable standard for protection of the health and safety of the general public;

NAS REPORT TECHNICAL BASES FOR YUCCA MOUNTAIN (CONT'D)

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

NAS REPORT TECHNICAL BASES FOR YUCCA MOUNTAIN (CONT'D)

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

NAS REPORT TECHNICAL BASES FOR YUCCA MOUNTAIN (CONT'D)

CONCERNS RELATED TO THE NAS YUCCA MOUNTAIN STANDARD

- **The need for, and contribution of, the NRC's sub-system standards.**
- **The proper role for, and the evaluation of, human intrusion scenarios.**
- **The proper timeframe for the regulatory compliance calculation of releases to the environment. Should peak dose be calculated? If so, what is the purpose of such a calculation?**

RADIOLOGICAL CRITERIA FOR DECOMMISSIONING

Committee has deliberated on the question of acceptable contamination levels since it was established in 1988.

Discussed proposed residual contamination level rule at 72nd meeting.

Comments:

- questioned applicability of 0.15 mSv/a (15 mrem/y) standard for residual contamination after D&D**
- urged NRC to foster govt-wide consistent & practical approach to regulation of very low levels of contamination**
- no evident technical basis to apply 4 mrem standard to aquifer**

RADIOLOGICAL CRITERIA FOR DECOMMISSIONING (CONT'D)

Discussed implementation plan at 78th meeting. Concerns included:

- **determination of background levels at fuel cycle facilities.**
- **consideration should be given to industry offer for actual "pilot" demonstration of efficacy of proposed rule.**

NRC'S LLW PROGRAM (SECY-95-201)

Committee is reviewing the LLW program in the context of the NRC's mission.

Present Status

78th Meeting - October 24-26, 1995

- Presentations by NMSS, NEI

**Attended All-Agreement States Meeting, Chicago - October 30 -
November 1, 1995**

NRC'S LLW PROGRAM (SECY-95-201) (CONT'D)

79th Meeting - November 15-16, 1995

- Presentations by representatives from:**
 - Office of State Programs**
 - DOE National LLW Management Program**
 - Nebraska**
 - New York State**
 - Fuel Cycle Facilities Forum**
 - Chair, E5, National Committee Radiation Control Program Directors**

SECY-95-201 QUESTIONS COMMITTEE WILL ADDRESS

- **The impact on the effective monitoring of the Agreement State program.**
- **The impact of the redistribution of personnel resources on the timeliness and effectiveness of a response to a request for technical assistance.**
- **The affect on the agency's public health and safety responsibilities.**
- **The impact of discontinuing research.**
- **Potential for regulatory fragmentation.**

ACNW HIGH PRIORITY ISSUES HIGH-LEVEL WASTE

- **The regulatory framework for permanent HLW disposal**
(includes the National Research Council's Report on the
Technical Bases for Yucca Mountain Standards)
- **Adequacy of program approach (process) -**
(the process used for site characterization at Yucca Mountain)

ACNW HIGH PRIORITY ISSUES HIGH-LEVEL WASTE (CONT'D)

- **Technical site suitability**
(the science involved in site characterization)
- **Repository thermal loading/coupled processes**
(models used to predict repository behavior)
- **License application review plan**
(The NRC staff's repository licensing strategy)
- **Two-stage licensing**
(The construction permit/operating license process)

LOW-LEVEL WASTE

- **Role of NRC/ACNW in LLW process**

(including the Committee's review of SECY 95-201, LLW options)

- **Use of risk based regulation**

(should there be a shift from deterministic regulations towards risk-based regulations)

- **Role of ACNW in decommissioning**

(an example would be acceptable residual radiation levels when a nuclear facility permanently closes)

PERFORMANCE ASSESSMENT

- **Treatment of uncertainty in bounding analyses**
(an example would be a determination that an applicant has provided sufficient site characterization data)
- **Role of expert judgment**
(how will formally elicited expert judgment be used in the decision process?)

LESSON LEARNED AT WARD VALLEY

**Dr. Martin J. Steindler
Commission Briefing
NOVEMBER 16, 1995**

**HLW HYDROLOGY RESEARCH AND
GROUNDWATER TRAVEL TIME
REGULATION**

**Dr. William J. Hinze
Commission Briefing
November 16, 1995**

OVERVIEW OF HLW HYDROLOGY RESEARCH PROGRAM

- **ACNW supports NRC HLW hydrology research which is focused on licensing issues**
 - **Groundwater is most likely pathway for radionuclide escape**
 - **There are large uncertainties in characterizing flow in fractured unsaturated rock**
 - **Hydrology research is providing valuable experience and insight into evaluating sites**

OVERVIEW OF HLW HYDROLOGY RESEARCH PROGRAM (CONT'D)

- **Despite ample justification for research the ACNW has made recommendations for improving**
 - **relevancy**
 - **timeliness**
 - **sufficiency**

RELEVANCY OF HYDROLOGY RESEARCH PROGRAM

- **RES needs to emphasize a risk-based approach in its research programs**
 - **Prioritization should be rooted in relevancy to estimated consequences and uncertainties**
 - **PA should be used in selecting research topics, bounding their scope, and setting priorities**
 - **RES and NMSS should ensure that results are used into IPA as the results become available**

RELEVANCY OF HYDROLOGY RESEARCH PROGRAM (CONT'D)

- **CNWRA's hydrology research**
 - **Needs to be focused on understanding critical conditions and processes that are significant problems from a performance or compliance perspective**
 - **Present program contributes to capability to understand and evaluate models used in licensing process**

RELEVANCY OF HYDROLOGY RESEARCH PROGRAM (CONT'D)

- **University of Arizona's hydrology research**
 - **Even though Apache Leap site is not an exact analog to Yucca Mountain, the process-oriented research leading to a fundamental understanding of flow in unsaturated, fractured rock**
 - **Research should become more licensing oriented and applied to licensing products and activities**

SUFFICIENCY OF HYDROLOGY RES PROGRAM

- **Needs to anticipate new research needs resulting from the NAS recommendations on technical bases for standards, e.g., flow in the saturated zone, dilution, defining reference biosphere**
- **Needs to place higher priority on updating research program to meet needs of changing regulatory environment**
- **Close coupling is missing between hydrology research and other related disciplines, e.g., volcanism, tectonics, and among hydrology research programs**

TIMELINESS OF HYDROLOGY RES PROGRAM

- **Emphasize timely delivery of research products to accommodate changing program schedules**
- **Modify priority, design, and procedures of research program to changing regulatory milestones**

CONCLUSIONS

- **Hydrology research is important to staff's capability to license a HLW repository**
- **NRC staff should ensure that the NRC's program is**
 - **relevant to NRC's licensing evaluation of repository**
 - **priorities reflect changes in resources and regulatory needs**
 - **research results are available in a timely manner**

ISSUES RELATED TO GUIDANCE ON 10 CFR 60 GROUNDWATER TRAVEL TIME (GWTT) REGULATIONS

- **GWTT reviewed in FY 95 because of regulatory significance and development of draft guidance**
- **NAS technical bases recommendations if accepted will reduce the need to focus on GWTT and other subsystem requirements**
- **Evaluation of GWTT still important for the use of a multiple barrier approach, and the evaluation total system performance**

ISSUES RELATED TO GUIDANCE ON 10 CFR 60 GROUNDWATER TRAVEL TIME (GWTT) REGULATIONS (CONT'D)

- **1000 year GWTT concept should be implemented with enough flexibility to allow for consideration of volumetric flux as part of evaluation of GWTT**
- **NMSS and RES staffs should be commended for their effective communications with DOE**

**REGULATORY ISSUES IN PERFORMANCE
ASSESSMENT FOR LLW MANAGEMENT:
A RISK PERSPECTIVE**

**DR. B. JOHN GARRICK
COMMISSION BRIEFING
NOVEMBER 16, 1995**

OVERVIEW OF RISK PERSPECTIVE

- **Traditional Deterministic Approach**
 - **Important role in demonstrating compliance with regulations**
 - **Can be unnecessarily conservative**
 - **Distinction lost between bounding analyses and expected performance**
- **PRA Policy Statement**
- **Risk Based Approach in Radioactive Waste Disposal**
 - **Implied elements of probability in regulations**
 - **Consider risk in a more coherent fashion -PRA evaluations as realistic as practicable and appropriate**

OVERVIEW OF RISK PERSPECTIVE (Cont'd)

- **Fundamental Risk Questions**
 - **Scenarios -- what can go wrong?**
 - **Probabilities -- how likely is it?**
 - **Consequences -- what are they?**
- **Couple to Regulatory needs**

ACNW REVIEWS AND COMMENTS ON LLW PA PROGRAM

- **Continuing Interest in a Risk Perspective in evaluation of Low-Level Radioactive Waste Disposal**
- **ACNW letters on NRC LLW Performance Assessment Program**
 - **Regulatory issues in low-level radioactive waste disposal performance assessment (June, 1995)**
 - **Review of the low-level radioactive waste performance assessment program (June, 1994)**
 - **NRC capabilities in computer modeling and performance assessment of low-level waste disposal facilities (December, 1991)**

REGULATORY ISSUES IN LLW PERFORMANCE ASSESSMENT

- **NRC Staff Briefing on LLW Regulatory Issues in March, 1995**
- **Committee Provided Comments to the Commission in June 1995**
 - **Generally supports staff's approach**
 - **Main concerns are interpretation and implementation of a probabilistic methodology for Performance Assessment**
 - **Recommends staff be more focused on the safety performance measures**
 - **Recognizes staff's traditional defense-in-depth philosophy**
 - **Demonstration of compliance with the regulations should not blur the overall performance of specific LLW site**

ACNW COMMENTS ON LLW PA REGULATORY ISSUES

- **Consideration of Site Conditions, Processes, and Events in Performance Assessment**
 - **Agrees with staff approach for a reference natural setting**
 - **Need to consider realistic phenomena that pose a significant risk**
 - **Should address occurrence frequency**
 - **May exclude events or scenarios accounted for through regulatory siting or design considerations**

ACNW COMMENTS ON LLW PA REGULATORY ISSUES (Cont'd)

- **Performance of Engineered Barriers**
 - **Concern with staff assumption that beyond 500 years engineered barriers in a degraded state**
 - **Applicant should have latitude to take credit that can be demonstrated through analysis and design**
 - **Underlying criterion should be health and safety consequences for overall disposal system**

ACNW COMMENTS ON LLW PA REGULATORY ISSUES (Cont'd)

- **Time Frame for Performance Assessment**
 - **Merit in choosing a generic maximum time frame, such as 10,000 years, but should not lose focus on site specific performance**
 - **Variability of long-lived activity in LLW could result in peak dose occurring at times longer than 10,000 Years for some sites**
- **Treatment of Sensitivity and Uncertainty in LLW Performance Assessment**
 - **A necessary component in a credible performance assessment**
 - **Strongly supports evaluating uncertainties and sensitivities using probabilistic methods**
 - **Concern with using "conservative bounding point values"**

FUTURE ISSUES

- **Committee Believes that the Application of Peak Dose is an Important Issue and Will Report to the Commission After Timely Review**
- **Committee Will Review Draft for Public Comment of the Branch Technical Position on Low-Level Waste Performance Assessment**
- **Simplified Performance Assessment Models (SPM) for Waste Systems**
 - **Committee interest in SPM**
 - **Motivation for developing SPM's**



UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, D.C. 20565

November 9, 1995

MEMORANDUM TO: The Commission

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

SUBJECT: BRIEFING PACKAGE FOR THE NOVEMBER 16, 1995 BRIEFING TO THE
COMMISSION BY THE ADVISORY COMMITTEE ON NUCLEAR WASTE

The Advisory Committee on Nuclear Waste (ACNW) is scheduled to meet with the Commission on October 16th from 2:00 pm to 3:30 pm to discuss items of mutual interest. The ACNW plans to discuss the following topics:

2:00 pm - 2:30 pm	Dr. Paul Pomeroy, Chairman, Introduction and Status of Reviews in Progress: a) NAS Report on Technical Bases for Yucca Mountain b) Radiological Criteria for Decommissioning c) LLW Alternatives SECY 95-201 d) ACNW High Priority Issues in HLW and LLW
2:30 pm - 2:50 pm	Dr. Martin J. Steindler, Lesson Learned at Ward Valley (report dated 8/10/95)
2:50 pm - 3:10 pm	Dr. William J. Hinze, HLW Hydrology Research Program and Groundwater Travel Time (reports dated 5/25/95 and 11/6/95)
3:10 pm - 3:30 pm	Dr. B. John Garrick, Vice Chairman, Regulatory Issues in LLW Performance Assessment - A Risk Perspective (report dated 6/28/95)

Copies are enclosed of the following reports to the Commission that will serve as the basis for the discussions at the subject meeting:

1. The U.S. EPA Preproposal Draft of 40 CFR Part 193 and the NRC's Proposed Radiological Criteria for Decommissioning, April 28, 1995.
2. Lesson Learned From the Ward Valley California LLW Disposal Facility Siting Process, August 10, 1995.
3. Comments on the High-Level Radioactive Waste Research Program in Hydrology, November 6, 1995.

4. Issues Related to Guidance on 10 CFR 60 Groundwater Travel Time Regulations, May 25, 1995.
 5. Regulatory Issues in LLW Disposal Performance Assessment, June 28, 1995.
- Copies of viewgraphs will be provided to the Commission prior to the meeting.

Attachment: As Stated



UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, D.C. 20566

April 28, 1995

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

Dear Chairman Selin:

SUBJECT: THE U.S. EPA PREPROPOSAL DRAFT OF 40 CFR PART 193 AND THE
NRC'S PROPOSED RADIOLOGICAL CRITERIA FOR DECOMMISSIONING

At its 71st meeting, February 21-22, 1995, the Advisory Committee on Nuclear Waste had presentations from and held discussions with representatives from the U.S. EPA, the NRC staff, and the Nuclear Energy Institute on EPA's Preproposal Draft (hereinafter referred to as Draft) of 40 CFR Part 193, "Environmental Radiation Protection Standards for the Management, Storage and Disposal of Low-Level Radioactive Waste." We initiated this review at the request of a Commissioner and because of its relevance to the Committee charter and program plan. As an adjunct to the discussions of factors impacting the generation and disposal of LLW, the Committee heard at its 72nd meeting, March 15-16, 1995, a presentation by and discussed with the NRC staff issues on the residual contamination levels associated with the decontamination of facilities and sites used for activities regulated under the Atomic Energy Act. These discussions addressed the bases for and the impact of levels of residual contamination allowed under the proposed decommissioning rule.

The Draft is divided into three subparts. Subparts A and B concern the management, storage and disposal of LLW and Subpart C concerns groundwater protection. Subparts A and B cite an upper limit to the annual committed effective dose (CED) of 0.15 mSv (15 millirem). Subpart C requires that the level of radioactivity from the disposal system in any underground source of drinking water be less than the maximum contaminant level (MCL) which, for radionuclides, is equivalent to an annual CED of 0.04 mSv (4 millirem).

The Committee could not evaluate the technical bases for the Draft or for many of the topics presented in the text accompanying the Draft since the background information documents, the regulatory impact analysis, and the environmental impact analysis in which such information is expected to be detailed are not yet available. Therefore, we focused our discussions and review on the apparent bases for the action recommended by the EPA and also estimated the potential impacts that were evident from the text that accompanied the Draft. The absence of detailed scientific analyses that lead to the standards in the Draft makes our conclusions less firmly

based than desirable. We plan to examine the technical issues as soon as the supporting documents become available.

We believe the Draft can be divided into two parts that can be considered separately. The first part deals with the protection of the health and safety of the public and is represented by Subparts A and B. The second concerns the application of the drinking water standards and is found in Subpart C. On that basis, we offer the following conclusions:

1. The standards in Subparts A and B dealing with the management, storage and disposal of LLW and its relation to public health and safety may effectively provide the same extent of protection as is obtained from provisions in 10 CFR Part 61 and 10 CFR Part 20 when these regulations are combined with application of the ALARA principle. Although there may be some differences in applicability of each of the NRC regulations, we conclude that the Draft provides protection that appears to be redundant with that provided by the NRC regulations. This conclusion is based on the NRC staff calculation that the 25/75/25 millirem regulation found in Section 61.41 is equivalent to the 0.15 mSv (15 millirem) in the Draft. In addition, in the absence of a clear intent in the Draft, we recommend that the limiting individual (or member of the public) subject to exposure from the LLW be clarified to mean "the average member of the critical group."
2. The selection of the 0.15 mSv (15 millirem) annual CED represents an unnecessarily conservative fraction of the 1 mSv (100 millirem) annual CED limitation recommended by the International Commission on Radiological Protection (ICRP) and the National Council on Radiation Protection and Measurements (NCRP) for the population. The need to partition the annual recommended limit among several sources from which a person is likely to be exposed appears justifiable. We have not found explicit guidance from the various national or international bodies, e.g., ICRP, on this subject.

Nevertheless, we believe that one-third (Reference 4) or one-fourth of the 1 mSv limitation is more easily justified, based on the likelihood that no more than three or four separate, regulated sources will affect the exposed person at any instance. The selection of one-seventh of the annual limit, i.e., the assumption that a person will encounter a simultaneous dose from seven different, regulated sources, appears to be unjustified, particularly since the application of the ALARA principle accompanies all such NRC regulatory actions. In addition, the nature of the partitioning of the annual effective dose limit is highlighted by the NCRP comment (Reference 3) that ". . . whenever the potential exists for exposure of an individual member of the public to exceed 25

percent of the annual effective dose limit as a result of irradiation attributable to a single site, the site operator should ensure that the annual exposure of the maximally exposed individual, from all man-made exposures (excepting that individual's medical exposure), does not exceed 1 mSv on a continuous basis. Alternatively, if such an assessment is not conducted, no single source or set of sources under one control should result in an individual being exposed to more than 0.25 mSv annually."

We also have reservations about the applicability of this level to residual contamination following the decontamination of a site or facility. This is especially pertinent when it is noted that the permissible residual activity limit is further reduced by the dose attributable to drinking water. Thus, the net allowed exposure of a person in the most exposed group could actually be as low as 11 mrem annually, a level that, especially when in concert with the ALARA principle, becomes unnecessarily restrictive and without justification. The impact of such regulations on the volume of LLW generated by decommissioning and the risk associated with the generation, transport, and disposal of this LLW require a reevaluation of these regulations.

3. The application of the drinking water standard to the disposal of LLW (Subpart C of the EPA Draft) presents, for at least the several reasons cited below, an entirely different approach to the promulgation of generally applicable environmental standards. The material in the Draft and discussions during our meeting indicated that both the application of the drinking water standard and the level of that application is not now based on evident rationale, in part because the background information documents are not available.
 - a. There is no evident technical basis for the application of the drinking water standard (applied at the tap) to an underground aquifer at the boundary of the LLW disposal facility. In fact, the text accompanying the Draft indicates clearly that this application is a policy issue and not a technically driven standard. We believe that the EPA should provide the cost-benefit support for such a decision and, in the absence of documents supporting the Draft, we have seen no such support.
 - b. The application of the drinking water standard as in the Draft has the effect of moving the point of compliance from the water tap, as it is for the existing drinking water standard, to the fence of the disposal facility. An important factor included in this shift is the definition of drinking water adopted by the EPA which includes waters containing concentrations of solids of

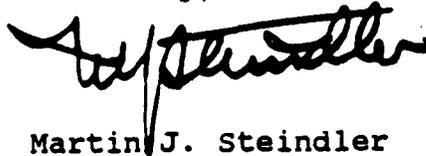
levels significantly above those that can be used for human purposes without treatment. We believe that this change may severely limit, without providing an appropriate benefit, the use of any humid site, otherwise qualified, to serve as a LLW disposal facility.

- c. The introduction of a new standard, particularly the coupling of the exposure standards with the drinking water standard, may introduce confusion and delays in the siting of LLW disposal facilities. In the absence of substantial and necessary improvements in the protection of the health and safety of the public, the application of the Draft standard is likely to be detrimental to progress in siting LLW disposal facilities. A significant refocusing of the application of the Draft standard on the health and safety of the public may therefore be warranted.
 - d. We see little technical justification based on the protection of the health and safety of the public for a 0.04 mSv (4 millirem) annual CED for drinking water. In addition, the identification of nuclides that are to be compared to the standard and the relationship of the contributing nuclides to those that are naturally present point to the need to define requirements that modify the application of the standard to selected aquifers owing to the existing levels of certain nuclides. Hence, a level of radioactive contamination that is equivalent to the 0.04 mSv annual dose is not always acceptable as an expression of an environmental standard, and EPA is seeking alternatives to the application. The potential for shifting the drinking water standard depending on the nature of the background indicates clearly that the standard is not in concert with real situations. If the EPA is to protect resources, then other means, e.g., legislative provisions, must be devised to accomplish this goal.
4. We agree with one aspect of the motivation of the EPA to provide the Draft at this time. The standards and regulations pertaining to the management and disposal of LLW by the DOE and by commercial activities are scattered throughout the Federal regulations and are not consistently defined. A single source of standards, coupled to a set of uniform NRC regulations on the management of LLW, would represent a desirable alternative.
 5. We are aware of the communication from the EPA (Reference 5) offering to waive the application of the Draft standard to the NRC if the EPA drinking water protection standard were to be included in the NRC regulations.

Since the general protection afforded by existing NRC regulations already appears to be equivalent to those proposed in the Draft, and since the applicability of the groundwater standard to the LLW disposal site is apparently not technically justified, we recommend that the proposed waiver be studied further to ensure that there are benefits to the protection of the public that could only be obtained by its acceptance. We do not see such benefits at this time.

The Committee plans to continue the study of the Draft once the background information documents and other documents become available. We believe that at present there appears to be too little information for a complete technical evaluation of the Draft, and we recommend that the Commission defer its final decision. It is likely, however, that the impact of the Draft may be detrimental to the progress in implementing LLW disposal among the State compacts and, therefore, the EPA should be urged to complete the standards development process including issuance of the background information documents as soon as possible. Finally, in light of the similarities in the recommendations of the EPA regarding LLW and the NRC staff regarding residual contamination levels following decommissioning, the Commission is urged to foster a government-wide consistent and practical approach to the regulation of very low levels of contamination.

Sincerely,



Martin J. Steindler
Chairman

References:

1. Preproposal Draft, "Environmental Radiation Protection Standards for the Management, Storage and Disposal of Low-Level Radioactive Waste (40 CFR 193)," November 30, 1994
2. Radiological Criteria for Decommissioning, Federal Register, Vol. 59, No. 161, pp. 43200-43232, August 22, 1994
3. National Council on Radiation Protection and Measurements, NCRP Report 116, "Limitation of Exposure to Ionizing Radiation," p.47, March 1993
4. Clarke, Roger H., "The ICRP Principles of Radiological Protection and their Application in Setting Limits and Constraints for the Public from Radiation Sources" (Presentation to the Nuclear Regulatory Commission, January 12, 1995)
5. Letter dated October 21, 1994, from Margo T. Oge, EPA, to Robert M. Bernero, Office of Nuclear Material Safety and Safeguards, NRC, regarding EPA's preferred option for dealing with groundwater protection at commercial LLW disposal sites



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

August 10, 1995

The Honorable Shirley A. Jackson
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Chairman Jackson:

SUBJECT: LESSON LEARNED FROM THE WARD VALLEY, CALIFORNIA, LOW-LEVEL WASTE DISPOSAL FACILITY SITING PROCESS

During its 75th meeting on June 21-22, 1995, the Advisory Committee on Nuclear Waste (ACNW) reviewed the National Academy of Sciences (NAS)/National Research Council report on the low-level waste disposal site at Ward Valley, California, and heard a presentation on this topic from a member of the NAS Panel. The Committee also has heard several presentations on issues related to the hearings held on the previously proposed low-level waste disposal site at Martinsville, Illinois, and several of the other proposed low-level waste disposal sites, e.g., Texas, Nebraska. This general topic is part of the waste facility reviews described in the Program Plan of the Committee transmitted to the Commission on November 10, 1993.

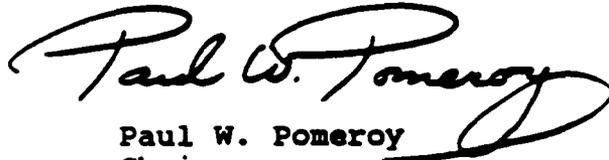
The Committee believes that the NAS report and the process used to formulate it were appropriate and thorough. The issues raised for and by the NAS Panel appeared largely to be pertinent and relevant to the health and safety of the public. The Ward Valley site has received intense technical and political scrutiny, and it is not our present purpose to comment further on these facets of the proceedings.

The ACNW has brought to the attention of the Commission lessons learned from the low-level waste facility-siting reviews and hearings that could be useful if applied elsewhere. This was part of the thrust of our interactions with the NAS Panel member during the presentation noted above. The NAS Panel identified a key lesson that the Committee strongly believes is broadly applicable; i.e., the process of developing information on a potential site of a low-level waste disposal facility should be accompanied, preferably from its initiation, by an independent, ongoing peer review that is focused on the scientific and technical quality and completeness of the field investigations, the analytical program, and the planning of the work that accompanies them. Such a review should be conducted by a recognized and demonstrably competent panel of experts.

One important benefit derived from the review process would be the identification of uncertainties and unrealistic assumptions in the site qualification analyses that could reasonably be subject to adverse reactions by licensing authorities or intervenors. Any site-evaluation process is expected to be a comprehensive and defensible technical analysis that supports conclusions about the suitability of a site. We believe that a peer review panel functioning as long as possible in parallel to the investigations would measurably enhance the quality of the final outcome and its visibility.

The Committee recognizes that the low-level waste sites to be developed in the near future are likely to be under the purview of Agreement States. Nevertheless, for those states in which a low-level waste facility is contemplated, the Committee believes the NRC staff should provide a plan that describes the process of forming such peer panels and the way in which their output can best be used. We believe this lesson, while stemming from the concerns about low-level waste facility siting, is broadly applicable to activities, especially in the siting area, in which the data-gathering and analytical processes are designed to yield readily defensible conclusions.

Sincerely,



Paul W. Pomeroy
Chairman

Reference:

"Ward Valley: An Examination of Seven Issues in Earth Sciences and Ecology," National Research Council, Washington, D.C., 1995



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

November 6, 1995

The Honorable Shirley Ann Jackson
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Chairman Jackson:

SUBJECT: COMMENTS ON THE HIGH-LEVEL RADIOACTIVE WASTE RESEARCH PROGRAM IN HYDROLOGY

This letter report communicates the results of the Advisory Committee on Nuclear Waste (ACNW) review of the Office of Nuclear Regulatory Research's (RES) high-level radioactive waste (HLW) research program in hydrology. The Commission requested the Committee to examine and report on the relevancy, sufficiency, and timeliness of the HLW research program. The Committee previously reported on its review of volcanism, natural analogs, tectonics, and engineered barrier system research in the HLW program. The purpose of the Committee's review is to determine the role of hydrology research in the development of technical basis for regulatory guidance and evaluation of a license application for the proposed repository at Yucca Mountain, Nevada.

The Committee finds ample justification for the HLW hydrology research program and has important observations and recommendations to improve the relevance, sufficiency, and timeliness of the program. Our major findings are: (1) the risk significance of some of the ongoing work at the Center for Nuclear Waste Regulatory Analyses (CNWRA or Center) has not been demonstrated, (2) the Committee recommends that the staff emphasize the use of Performance Assessment (PA) to justify the basis of research projects, (3) RES needs to ensure that the projects and schedules of the hydrology research program are aligned with current needs of the licensing program and the impending changes in the Environmental Protection Agency's (EPA's) standards for the Yucca Mountain repository as a result of the National Research Council's technical bases findings (Ref. 1). For example, the longer time frame and risk-based standard recommended by the National Research Council panel may place greater emphasis on the dilution potential of the saturated zone, and (4) overall greater emphasis is needed on bringing projects to closure and packaging project results in usable formats for transfer to the licensing staff. These findings and others are discussed in more detail in the body of this report, and are later summarized at the end.

During 1995, the Committee devoted attention to the hydrologic aspects of site characterization at Yucca Mountain and related NRC preparations to evaluate a possible license application for a repository at Yucca Mountain. Of particular interest has been the guidance provided by NRC to the Department of Energy (DOE) on the interpretation and application of the subsystem requirements of 10 CFR Part 60 dealing with minimum groundwater travel time from the disturbed zone of

the repository to the accessible environment. Our comments on that subject were transmitted to you in our report of May 25, 1995. A logical followup to our evaluation of NRC's preparations for guidance on groundwater travel time is a review of the HLW hydrology research program. The DOE program schedule for site characterization, the implication of a new EPA standard for the potential Yucca Mountain repository, and possible changes in 10 CFR Part 60 add to the timeliness of our review. At our 77th meeting on September 20, 1995, the Committee was briefed on this topic by RES, the Office of Nuclear Material Safety and Safeguards (NMSS), the CNWRA, and the principal investigators of the NRC-sponsored HLW hydrology programs at the Apache Leap Research Site of the University of Arizona. This report is derived from the Committee's evaluation of the results of that briefing and subsequent deliberations.

Groundwater is the most likely agent to cause degradation of waste package containment, radioactive release from the engineered barrier system, and transport to the accessible environment. Hydrology research is a high-priority issue at NRC and has a prominent role in the draft HLW Research Program Plan (Ref. 2). Critical issues in hydrology include infiltration, conceptual models for fracture/matrix flow, parameter estimation, and radionuclide transport in both liquid and vapor phases. The hydrology research programs at the CNWRA and the University of Arizona receive approximately 15 percent of NRC's current annual funding for HLW research.

General Comments

In our report of August 24, 1994, to Chairman Selin regarding the HLW research program on volcanism, natural analogs, and tectonics, the Committee identified several general concerns that are also appropriate to the HLW hydrology research program. We note improvement in some other areas; for example, the effective technical communications between the NRC and DOE in matters related to the hydrology of the proposed Yucca Mountain repository site. Further, we are impressed with the advantages accrued to the hydrology research program as a result of the participation of external experts from the University of Arizona. Our general concerns are as follows:

1. Program Priorities

The selection and prioritization of specific research topics in hydrology can be improved by use of a risk-based approach. Prioritization should be rooted in the relevance of the research to estimated consequences and uncertainties. As a result, PA should have a prominent role in selecting research topics, bounding their scope, and establishing relative priorities. We see little evidence of the role of PA in the prioritization of current hydrology research topics or how hydrology research results will be used in Iterative Performance Assessment (IPA).

2. Key Technical Uncertainties (KTUs) and User Needs

In the Committee's report regarding research in volcanism, natural analogs and tectonics, we supported the ongoing activities of NMSS to fine-tune the KTUs and clarify user needs. We reemphasize the importance of this effort and urge a

timely closure on this project. In our previous report, we stated ". . . it was difficult for the Committee to identify how research project objectives and tasks are used to resolve specific KTUs." In our review of hydrology research, a direct connection is not obvious between specific projects and the needs of the licensing staff as specified by the key technical issues (KTIs) and KTUs. The rapidly evolving licensing procedures require the synchronization of hydrology research with changing NRC guidance and licensing concerns.

3. Integration of Research Activities

The hydrology at Yucca Mountain should be closely coupled with other disciplines such as tectonics, volcanism, and geochemistry in evaluating overall repository performance. However, as in the case of previous briefings by the NRC staff and principal investigators of research projects, hydrology research reports fail to identify general mechanisms to bring about needed integration. The focus is on discrete processes, and integration appears to be an ad hoc procedure relegated to the actions of individual investigators. The Committee recommends a more visible integration of discrete research elements.

4. Communications

The Committee is pleased to note the extensive technical communications among the various components of NRC involved in hydrology research and their counterparts at DOE. As a result, there is a sharper focus to the NRC research activities and broadening use of the results of the research by both NRC and DOE. We specifically recognize the quantity and quality of peer-reviewed journal publications by the principal investigators of the NRC-sponsored research at the University of Arizona. However, a concern we raised in our report of August 24, 1994, also is appropriate to the hydrology research. In that report, we recommended, and we continue to do so, that the RES staff convert the results of research at both the CNWRA and the University of Arizona into usable products for NMSS and others. This recommendation is especially applicable to the results from studies by the University of Arizona because of limitations in the principal investigators' views of regulatory concerns.

5. Role of NRC in Hydrology Research

In evaluating hydrology research, the Committee failed to obtain a clear-cut view of the criteria used by RES to identify its research projects. This is an especially critical concern in the current climate of decreasing resources. RES needs to clearly justify the NRC research program in hydrology as well as in other HLW topics.

The Committee believes there are valid reasons for the NRC to conduct research in hydrology related to the proposed Yucca Mountain repository site. Characterization and predictive modeling of fluid flow and transport in unsaturated fractured rock such as that encountered at Yucca Mountain is a relatively new, rapidly evolving science. There is little experience or understanding of governing processes and the behavior of fluids in fractures and faults, and few field demonstrations or standardized methodologies for obtaining parameter values necessary for modeling. The NRC staff is establishing

independent methods, approaches, and data bases, which will enable them to conduct confirmatory checks on DOE's models, modeling procedures, and data. Further, the NRC research is designed to develop and validate methodologies and data bases. Although of primary use to the NRC in the licensing process, this information can be influential in optimizing the hydrology site characterization process. NRC research is providing the NRC staff with valuable experience and insight into the sensitivity of various assumptions, methodologies, and approaches on evaluating site performance. These dividends provide the staff with needed confidence and increased credibility in evaluating DOE methods, models and approaches. Thus, we endorse hydrology research at NRC, but we recommend that these studies be used to better understand critical processes and to develop and validate scoping data and methodologies.

Specific Comments on Hydrology Research

The Committee recognizes the high quality of the research activities in hydrology being carried out for the NRC by the CNWRA and the University of Arizona and of the personnel involved in conducting and directing these studies. Further, we are pleased that to date some of the results of the hydrology research have proven useful in the guidance of regulatory policies and as background for technical assistance and have played a role in improving the site characterization at Yucca Mountain. Nonetheless, the Committee believes that significant improvements are possible and warranted in HLW hydrology research from the regulatory viewpoint. The following comments are intended to increase the overall effectiveness of the NRC HLW hydrology research program.

1. Relevance

CNWRA - The CNWRA is conducting research on regional and subregional hydrology of the Yucca Mountain site, including modeling of the high-hydraulic gradient north of the site and flow channeling in tuff, development of a methodology to evaluate the importance of spatially nonuniform infiltration on the flow of water in the unsaturated zone, and the origin and importance of perched water. The relevance of many of these studies is not apparent because they have not been shown to be significant from a risk perspective. However, an important contribution of the CNWRA research in hydrology is the sharpening of the staff's capability to evaluate and gain insights into conceptual and numerical models and analyses that are anticipated in the licensing process.

The goal of the Center's hydrology research projects is to understand existing site conditions rather than those critical conditions or processes that are potentially a problem from a performance or compliance perspective. For example, the Center is attempting to identify the "correct" model to explain the high-hydraulic gradient upslope from the proposed repository. We suggest that this program element be refocused to design and test bounding models and to perform preliminary analyses of their potential impact on repository performance. Resources would be better utilized by determining if the worst-case scenarios lead to failure to comply with the HLW standards and regulations than by attempting to define the "correct" model that explains the gradient. Although there is a need to better understand governing processes in subsurface hydrology

to develop reliable models and bounding conditions, the Center needs to ensure that these processes are risk significant before they are extensively researched.

University of Arizona - The continuing hydrology research of the University of Arizona at its Apache Leap Research Site is directed to understanding governing processes and modeling flow and transport, with emphasis on field methodologies and model testing at field and laboratory scales. The program addresses many potentially relevant issues such as conceptual models, spatial variability, model uncertainty, model abstraction, model validation and testing, and scaling properties. The Apache Leap Program is also making significant progress at integrating hydrology and geochemistry in designing experiments and interpreting results.

The geology and hydrology of the Apache Leap site are, to a first order, similar to the Yucca Mountain site in that both are in unsaturated, fractured tuff. However, other conditions are dissimilar, such as climate, hydrologic setting, and tectonic conditions. These differences lead to concern about the relevancy of the Apache Leap site as an analog to Yucca Mountain and the validity of the transfer of results from studies at Apache Leap to Yucca Mountain. Experience has shown that considerable care must be exercised in transferring lessons learned from one site to another. This caution is ameliorated by the focus of the research on the general understanding of the nature and relative importance of matrix/fracture flow in tuff rock in an unsaturated environment, field-scale demonstrations, and methodology development, all of which can lend credibility and confidence to NRC's regulatory decisions.

The University of Arizona studies are leading to fundamental understanding of flow and transport processes in unsaturated, dual-continuum volcanic rocks. This understanding will lead to better interpretation and evaluation within the regulatory framework of hydrologic data from Yucca Mountain and to more credible PA. Of particular note are the hydraulic, pneumatic, and tracer tests being used to test alternative models and to evaluate the stochastic continuum approach for defining flow and transport in rocks with both matrix and fracture permeability. However, for the NRC to obtain maximum use of the results of the Apache Leap studies, RES and NMSS should, on a regular basis, interpret and translate the results into meaningful guidance.

2. Sufficiency

NRC's licensing needs are evolving. We anticipate that new research issues will emerge with, for example, the NMSS staff's identification of long-term and short-term research needs for the specific elements of the vertical slice approach. RES must be ready to modify the priorities of its research program, including hydrology research projects. For example, current research projects should place greater emphasis on the role of fault zones on flow and transport in unsaturated tuff rock. This approach recognizes that faults, as identified by the NMSS staff in their presentations to us, are a critical but poorly known hydrologic element of the vertical slice, "Hydrologic Characterization of Structural Features That Affect Water and Vapor Movements."

The Committee was puzzled that none of the projects appear to have been aimed at providing information pertinent to groundwater travel time. Although the importance of this current subsystem provision of Part 60 may change as the result of incorporation of the report by the National Research Council on Yucca Mountain standards, this regulation is pertinent to the behavior of water in the environment of the repository. The difficulties in the establishment of the travel time, made evident in reviews of this matter by the Committee, point to the need to identify research programs that will enable the NRC staff to evaluate this hydrologic characteristic.

The Committee is also concerned about insufficient research at the interface of specific research elements. We have already noted the apparent deficiencies in mechanisms for integrating research activities. Research on the coupling of hydrology of Yucca Mountain with, for example, volcanism and tectonics appears to be deficient in the current program. Briefings on the hydrology research program also failed to show how the two projects at the CNWRA on regional and subregional hydrology are integrated with each other, with related work at the Center, and with the research being performed at the Apache Leap Research Site.

3. Timeliness

No clear evidence has been made available to the Committee that timeliness of the hydrology research is a compelling factor in prioritizing, designing, or conducting the program. We realize that the time line for evaluating the technical site suitability of Yucca Mountain and other prelicensing and licensing issues has been modified recently. However, the NRC staff must be sensitive to those modified deadlines, such as the one requiring the Commission's comments on the high-level findings, and assure the Commission that research results are available on a timely basis.

Summary

The Committee's major findings are summarized as follows:

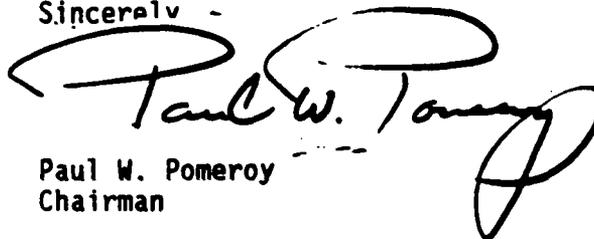
- RES and NMSS staffs should be commended for the effective communications that exist between NRC and DOE.
- RES needs to place greater emphasis on establishing well-defined, risk-based priorities for its programs and ensuring that the results of hydrology research are fed back into IPA analyses. Greater emphasis needs to be placed on using PA to integrate results from all research disciplines and in turn establishing research priorities and guiding further research.
- RES should pay particular attention to new research needs that may result from the National Research Council's technical bases recommendations, and ensure that it can deliver useful products in the needed time frame. NRC should continue to place high priority on updating its current research program and schedules to meet the evolving needs of the licensing program, which continues to change in response to reduced resources and the changing regulatory environment.

- The CNWRA research program in hydrology provides the NRC staff with valuable experience and insight into the sensitivity of assumptions, methodologies, and approaches in evaluating the performance of the Yucca Mountain site. However, the relevance of this work has not been clearly established from a risk perspective.
- The NRC research at the Apache Leap site should focus on answering regulatory questions and should become more results-oriented with respect to specific application to licensing products and activities. Although the Apache Leap site itself is not an exact analog to Yucca Mountain, the research is leading to a fundamental understanding of flow and transport processes in unsaturated, fractured, volcanic rock, which, in turn leads to greater credibility and confidence in NRC's independent review of a license application.
- Close coupling is missing between this hydrology research and IPA and other closely related disciplines, including thermal studies, geochemical transport, coupled processes, and tectonics. Also lacking is a strong link between the research at the CNWRA and the University of Arizona.
- The Committee believes there are important reasons for the NRC to conduct hydrology research in the HLW program. For example, flow and transport in unsaturated fractured rock, such as encountered at Yucca Mountain, is poorly understood and requires further elaboration to assist in PA. We endorse this research program, but recommend a greater emphasis on understanding significant processes and developing and validating data and methodologies.

Conclusion

The Committee supports the HLW hydrology research program and believes that the research results will enhance the NRC staff's capability to license an HLW repository. However, the NRC staff needs to ensure that the program is relevant to the licensing evaluation of the performance of the repository, that the research priorities reflect resource and changes in regulatory needs, and that research results are available in a timely manner.

Sincerely



Paul W. Pomeroy
Chairman

References:

1. National Research Council, "Technical Bases for Yucca Mountain Standards." 1995
2. U. S. Nuclear Regulatory Commission, draft NUREG-1406, "NRC High-Level Radioactive Waste Research Program Plan," February 28, 1992



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

May 25, 1995

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

Dear Chairman Selin:

SUBJECT: ISSUES RELATED TO GUIDANCE ON 10 CFR 60 GROUNDWATER
TRAVEL TIME REGULATIONS.

In accordance with its program plan, the Advisory Committee on Nuclear Waste has reviewed the basis of the groundwater travel time (GWTT) requirement in 10 CFR Part 60. It also has reviewed the ongoing activities of the NRC staff and the U. S. Department of Energy (DOE) on this topic. The purpose of this letter is to convey our observations on the regulatory aspects of GWTT and our recommendations on the pending guidance by the NRC staff to DOE in this important area. Our conclusions are derived from two working group meetings, one in December 1993 on the status and methodology for study of groundwater flow in the unsaturated zone at the proposed repository at Yucca Mountain, Nevada, and another in October 1994 on the use of groundwater dating techniques in determining GWTT. In addition, we heard presentations from the NRC staff, and representatives from DOE and the State of Nevada at our 71st, 72nd, and 73rd meetings.

In 10 CFR 60.113, the NRC establishes the performance objectives for specific barriers after permanent closure of the repository. These objectives implement the Commission's defense-in-depth philosophy. The subsystem requirement in 10 CFR 60.113(a)(2) specifies a quantitative measure related to the inherent capability of the geologic environment of the emplaced waste to contain radionuclides released to the accessible environment in case of failure of the engineered barrier. This part of the regulations states, "The geologic repository shall be located so that the pre-waste-emplacement groundwater travel time along the fastest path of likely radionuclide travel from the disturbed zone to the accessible environment shall be at least 1000 years or such other travel time as may be approved or specified by the Commission."

The systematic regulatory analysis of the NRC high-level waste regulations identified two key technical uncertainties (KTUs) in the GWTT subsystem requirement. Potential ambiguities have been identified in the terms "fastest path of likely radionuclide travel" and "disturbed zone." As a result, the NRC staff is drafting guidance to clarify these and other potential uncertainties in 10 CFR 60.113(a)(2) and related sections of Part 60. Further, the wording of the GWTT regulation in Part 60 is similar to the GWTT disqualifying condition in 10 CFR Part 960 that DOE will use to determine the technical site suitability (TSS) of Yucca Mountain. Thus, the guidance being prepared by the NRC staff not only will have a major impact on the evaluation of the repository license application but also will be applicable to the Commission's comments on the TSS of Yucca Mountain.

Our review of the basis of the GWTT regulation resulted in the following observations and related recommendations.

1. Role of GWTT

The GWTT requirement is designed to be a numeric measure of the geologic system's ability to contain radionuclides; the geologic system serves as one of the redundant barriers. Thus, GWTT is one element of the triad that makes up the Commission's defense-in-depth approach. However, this subsystem regulation alone is not intended to satisfy the entire performance requirement of the current Environmental Protection Agency high-level waste repository standard. Thus, the NRC staff should clarify in its guidance that the intent of the GWTT requirement is to provide reasonable assurance that the geologic barrier will be effective. The NRC guidance should stress that, because of the overall emphasis on the performance of the repository and the uncertainties in estimating GWTT, adherence to the 1000-year requirement should be interpreted liberally.

2. Need for timely guidance

Because of the rapid progress of the geohydrology studies at Yucca Mountain, early, comprehensive guidance is needed on the KTUs and other technical issues concerning GWTT.

DOE currently plans to complete the acquisition of data and analyses for its technical basis report on geohydrology in its TSS program in early 1997. Although DOE will evaluate the Yucca Mountain site against the requirements in 10 CFR Part 960, the GWTT disqualifying condition of 10 CFR 960 closely parallels the subsystem regulation in 10 CFR Part 60. Further, the Commission is required to comment on the Yucca Mountain site suitability determination that is scheduled to be sent to the President in the year 2000. Thus, it is urgent

that uncertainties in the GWTT regulation be reduced through a carefully developed technical position. Where applicable, the guidance should be specific and quantitative and based on physical or statistical justification.

3. Scope and content of GWTT guidance

Our recommendations for the scope and content of the NRC staff guidance on the GWTT requirement of 10 CFR Part 60 are as follows:

a. Determining GWTT along the fastest path of likely radionuclide travel.

The NRC staff's technical position on defining and determining GWTT along the fastest path of likely radionuclide travel as specified in 10 CFR 60.113(a)(2) is required to eliminate the regulatory uncertainty. The complex, interactive pathways possible in the matrix, fracture, and fault flow conduits in the proposed unsaturated zone repository at Yucca Mountain result in a variety of GWTTs between the disturbed zone of the repository and the accessible environment. Determining the groundwater paths and their travel time is likely achievable with acceptable uncertainties but may require probabilistic calculations to define the distribution of GWTTs. We believe the use of a measure of the central tendency may be acceptable but urge that the technical guidance by the NRC staff indicate the need for justifying any such selected attribute of the GWTT distribution.

We also believe that the NRC staff's position on GWTT should address the possible incorporation of the volumetric flux of water from the disturbed zone to the accessible environment, in that GWTT is not necessarily related to flux. Consideration of the volumetric flux is predicated on the reasonable assumption that higher volumes of water will carry larger quantities of dissolved radionuclides and hence constitute a greater risk. The NRC staff should be urged to point its guidance toward the desirability of modulating the measure of GWTT with water flux.

b. Uncertainties in GWTT

A recognized issue in the determination of GWTT is the ability of geohydrologists to predict the groundwater paths and associated uncertainties in travel time values. We believe that after completion of adequate site characterization of Yucca Mountain and quantification of the sources of uncertainty, these predictions will be possible. DOE must gain an understanding of the saturated and unsaturated zone groundwater flow systems sufficient to bound, for example, the role of fracture flow, the location and behavior of faults as

flow conduits, and the potential role of perched water conditions in the flow system in estimating GWTT. Emphasis on the flow system through rock units underlying the repository horizon is also required. This information, together with definition of geohydrologic units, their relevant properties, and lateral and vertical variability, needs to be available to develop conceptual models of the geohydrologic system at Yucca Mountain.

To address uncertainties in conceptual models, guidance is needed on evaluating the results from multiple conceptual models and the use of information such as groundwater tracers, isotopic dating of *in situ* water, and related geoscience input to constrain and temper the models. All require careful application, integration, and interpretation, but in particular, the NRC staff should, in its guidance, caution against excessive reliance on the results from one method of isotopic dating of water that are not supported by results from other isotopic dating methods or other methodologies.

Further, the NRC staff guidance should encourage DOE to delimit the uncertainties associated with the proximity of the repository to fault zones. Potentially, fault zones provide pathways for rapid groundwater flow.

c. Definition of disturbed zone

The functional definition of the disturbed zone referred to in 10 CFR 60.113(a)(2) remains a KTU. The NRC staff in presentations to the Committee and at technical exchanges between NRC and DOE has proposed a method of defining and demarcating the disturbed zone that is based on a two-step process. The steps are to evaluate the effects of changes in physical and chemical properties of the rock volume of the site resulting from construction and the emplaced waste on pre-waste-emplacment GWTT and determine if the effect on pre-waste-emplacment GWTT is significant. The disturbed zone is the outer limit of the volume in which the GWTT has been "significantly" affected by the repository and its wastes. The staff's definition takes into consideration the rock volume that may affect the capability of the geologic barrier to contain waste, but does not allow credit to be taken if the effect of the repository is to lengthen GWTTs. This approach has been well received by DOE, and we believe it is appropriate. We urge the staff to proceed with it in developing its guidance, but we caution that the term "significant" when referring to the effect of the repository on pre-waste-emplacment GWTT will need further consideration. A suggested course of action is to define the term "significant" quantitatively in such a way that takes into

account the uncertainty and resulting effects of the possible changes of the physical and chemical properties on GWTT in the disturbed zone.

We are concerned that in the absence of a specific thermal loading strategy it will be difficult for DOE to estimate the effects of repository heat and hence difficult to complete the pre-and post-waste-emplacment calculations. Also, DOE has indicated it will not have the results from heater block tests before it performs the post-waste-emplacment GWTT calculations. These deficiencies will result in great reliance on expert judgment in the assessment of post-waste-emplacment effects. The NRC staff should initiate as soon as possible a review of its strategy for evaluating whether DOE has bounded the behavior of groundwater flow in the post-waste-emplacment environment sufficiently to determine compliance with the GWTT regulation and the overall repository performance criteria.

d. Definition of pre-waste conditions

The lack of a clear definition for the term "pre-waste-emplacment" in the GWTT regulation requires that NRC staff provide guidance on what is meant by pre-waste-emplacment conditions. The groundwater conditions are part of a dynamic, constantly changing system as a result of local and regional climatologic variations, modifications in geohydrologic parameters, and disruptive effects due to subsurface site characterization. As a result, some geohydrologic data indicative of groundwater residence time reflect groundwater processes over a broad span of time rather than the present conditions. The effects of these factors are likely to be small over the totality of the repository site, but they need to be evaluated in terms of prescribing pre-waste-emplacment conditions and the need for and the method of extrapolating to a specified pre-waste-emplacment state.

e. Use of transport processes

DOE has proposed the use of transport processes, including diffusion, in the analyses of GWTT. These effects may significantly impact the GWTT results. The NRC staff technical position should provide clear guidance on the appropriateness of the use of transport processes and the rationale for this decision.

4. Consistency and integration with other guidance

The NRC staff needs to ensure that its technical position on the GWTT regulation is consistent and integrated with other NRC guidance including evaluation of the overall performance of the repository, approach to confidence building of models

and evaluation of uncertainty in modeling, use of expert judgment, and review of DOE's bounding analyses in support of its program approach. The staff may be able to narrow the scope of the GWTT technical position if the document contains information on how GWTT is related to or incorporates other issues and on where related guidance on these can be found.

5. Support for GWTT Guidance

We have observed little direct impact of the Center for Nuclear Waste Regulatory Analyses (CNWRA) in our review of the GWTT regulation. If the staff is not doing so already, we encourage it to take full advantage of the strong technical support available from the CNWRA in formulating the guidance required in the GWTT staff technical position. We look forward to reviewing supporting analyses from the CNWRA when we are briefed on the draft technical position before it is issued for public comment.

6. NRC/DOE interaction on GWTT

We have closely followed interactions between DOE and the NRC staff in their technical exchanges regarding GWTT and related issues at Yucca Mountain. We have been impressed with the professional standards of both groups, the increased frequency of these meetings, and their ability to maintain flexibility in their approaches. We commend both the NRC staff and DOE for their actions and encourage broadening of this type of interaction and demonstrated flexibility to other aspects of the high-level waste program.

Summary

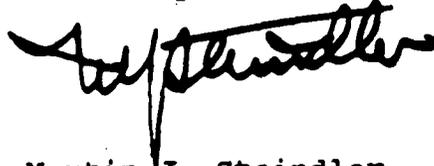
We believe there is a need to develop a technical position paper and guidance on various aspects of the GWTT subsystem regulation. We believe that the timing of activities by DOE and the indicated schedules point to a need to complete such guidance in the very near future. Such a technical position paper should address all of the currently identified relevant KTUs or identify where treatment of their subject matter can be found, and provide quantitative guidance to the extent possible. We urge that clarification of the definition of concepts such as the disturbed zone and pre-waste-emplacement conditions be specifically addressed. Further, the technical bases for evaluating adherence to the numerical regulation for GWTT should be addressed in the guidance in terms that will allow DOE to make early decisions on the need for data and analyses and the strategy for providing the necessary information to the NRC staff. This guidance should also either address data requirements, methodologies, and confidence-building procedures that will minimize the uncer-

The Honorable Ivan Selin

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tainties in the evaluation of this rule or identify where this information may be found.

Sincerely,

A handwritten signature in black ink, appearing to read "Martin J. Steindler". The signature is written in a cursive style with a prominent vertical stroke at the end.

Martin J. Steindler
Chairman



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

June 28, 1995

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

Dear Chairman Selin:

**SUBJECT: REGULATORY ISSUES IN LOW-LEVEL RADIOACTIVE WASTE DISPOSAL
PERFORMANCE ASSESSMENT**

As a continuation of the Advisory Committee on Nuclear Waste (ACNW) review of the Low-Level Radioactive Waste (LLW) Performance Assessment (PA) program, and consistent with its program plan, the NRC staff briefed the Committee on March 16, 1995, on recent LLW PA activities. The staff emphasized its response to comments received from the public on the preliminary draft Branch Technical Position (BTP) on LLW PA, including input from the LLW Performance Assessment Workshop on November 16-17, 1994. The Committee will review the draft BTP when it is available.

The NRC staff sought ACNW's advice on its proposed resolution of public comments on four regulatory issues:

- (1) Consideration of Site Conditions, Processes, and Events in Performance Assessment
- (2) Performance of Engineered Barriers
- (3) Time Frame for Performance Assessment
- (4) Treatment of Sensitivity and Uncertainty in Low-Level Waste Performance Assessment

CONSIDERATION OF SITE CONDITIONS, PROCESSES, AND EVENTS IN PERFORMANCE ASSESSMENT

The Committee agrees with the staff's preferred approach of developing a reference natural setting for performance assessment based on anticipated conditions, processes, and events. It is a reasonable approach to define the natural setting on the basis of information about the site, taking into consideration conclusions about future changes in the site. To the extent that the site information suggests it is important to consider such phenomena as earthquakes, climate changes, volcanic activity, etc., then it is also appropriate to include such threats in the definition of the natural setting. We caution the staff not to preclude "direct" or explicit consideration of certain events that may in fact be realistic, based on site information. From the risk perspective, if there is evidence that such threats could become a

reality, then it is also important to address the issue of occurrence frequency as a function of severity based on all the evidence from the site. In terms of what should be considered and what should not, the Committee believes in the principle of completeness, where completeness means if there is evidence of a significant contribution to risk, it should be considered; if not, that contribution to risk need not be analyzed further. The exception would be those events or scenarios that are already accounted for through regulatory siting or design considerations.

PERFORMANCE OF ENGINEERED BARRIERS

The Committee has some concern about the consistency of the staff's approach to the performance assessment of engineered barriers. On the one hand, the staff adopts the view that one should demonstrate the performance of engineered barriers for any time frame, while on the other hand, they indicate that it will be assumed that beyond 500 years the barriers are in a degraded state. Although the staff indicates that an applicant may take credit for a longer period of time than 500 years, there is certainly a lack of incentive for the applicant given the staff position. The applicant should have the latitude to take credit for engineered barriers that can be demonstrated through analysis and competent design. The selection of an arbitrary point in time appears to be without technical basis. The thrust of the staff position that seems to put most of the reliance for safety performance on site characteristics to assure containment is not an adequate basis for limiting the utility of a creative and convincingly designed engineered barrier. Some would argue that there is much more confidence in the state of knowledge of the containment capacity of a quantitatively specified engineered system than of a natural system based on the more difficult task of quantitative site characterization. In the end, the underlying criterion should be the health and safety consequences of the overall disposal facility. A reasonable interpretation of the 500-year requirement is that it be a minimum for engineered barrier integrity, and the BTP should reflect this approach.

TIME FRAME FOR PERFORMANCE ASSESSMENT

The Committee believes there is merit in choosing a generic maximum time frame for analyzing the safety of an LLW facility. We do caution the staff against letting time-frame limits detract from focus on the actual performance of a site-specific LLW facility. One important attribute of the LLW field is the variability in the radionuclide content of LLW. For example, much larger quantities of long-lived radionuclides are being disposed of as low-level waste than was previously anticipated. The result is that at some sites, peak doses will occur at times longer than 10,000 years. We believe the application of peak dose calculations to be an important issue and plan to report to you on this subject after a timely review of this topic. Again, the Committee urges the principle of completeness by assessing first the safety of a specific facility and then being satisfied that it is in compliance with the regulations. Nevertheless, the BTP should identify a time period such as 10,000 years, for which performance assessment of an LLW site should be completed and beyond which such analyses should not be required.

**TREATMENT OF SENSITIVITY AND UNCERTAINTY IN
LLW PERFORMANCE ASSESSMENT**

The Committee appreciates the difficulties the staff is having in adopting a probabilistic methodology in performance assessment. We agree with the staff's observation made in their March 16, 1995, presentation to the ACNW that the "treatment of uncertainty (is) a necessary component in a credible performance assessment." We believe the BTP should include requirements for the evaluation of uncertainties and sensitivities by probabilistic methods. The Committee reiterates its strong support of probabilistic methods as indicated in its letter of June 3, 1994.

On a more technical note, the staff identifies three types of uncertainties: (1) scenario uncertainty, (2) model uncertainty, and (3) parameter uncertainty. The Committee agrees that these are all important components of uncertainty, but suggests that the first two be considered together as they both are really part of the modeling process. A performance assessment model can be viewed as a structured set of scenarios, thus making the scenarios an integral part of the modeling; that is, the means of coupling specific physical processes. The coupling of the physical processes with the scenarios and their attendant uncertainties needs to be explicitly visible.

Another technical issue that adds some confusion to uncertainty analysis as discussed by the NRC staff in its March briefing on the BTP is the reference by the staff to "conservative point values to bound parameter ranges." It is the "to bound parameter ranges" part of this statement that is confusing. The staff appears to be suggesting that the probability distributions should be conservative. If so, this is a contradiction in logic. For the distributions to have meaning, they have to represent the analyst's full state of knowledge about the parameter or issue in question. The opportunity then exists to choose conservative values within that distribution, an example of which is that the 95th percentile of the distribution is below 100 mrem per year. Also, there is nothing to prevent selection of a point value outside the distribution. However, such choices should not be confused with the actual quantification of the uncertainty - a very important reference. The use of conservative bounding points amounts to artificially stretching out the distribution to represent a level of uncertainty that cannot be supported by the evidence.

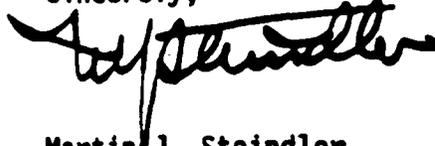
In summary, the Committee generally supports the staff's approach to each of the four issues listed above. Our concerns are mainly in the interpretation of the approaches and in the progress by the NRC staff toward the implementation of a probabilistic methodology for performance assessment and especially in the treatment of uncertainty. We recommend that the staff be more focused on the final result (i.e., the bottom-line safety performance measures), even though we recognize the attempt to encourage the defense-in-depth philosophy by focusing on such intermediate results as time frames for the assumed degradation of engineered barriers. We believe compliance with the regulations should not be

The Honorable Ivan Selin

4

at the expense of blurring the analysis of the overall performance of a specific low-level waste site.

Sincerely,

A handwritten signature in black ink, appearing to read "M. Steindler", written in a cursive style.

Martin J. Steindler
Chairman