

UNITED STATES OF AMERICA NUCLEAR REGULATORY COMMISSION

Title: BRIEFING ON IMPLEMENTATION OF THE U.S. ENVIRONMENTAL
PROTECTION AGENCY'S HIGH-LEVEL WASTE DISPOSAL STANDARDS

Location: ROCKVILLE, MARYLAND

Date: NOVEMBER 21, 1989

Pages: 75 PAGES

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BRIEFING ON IMPLEMENTATION OF THE U.S.
ENVIRONMENTAL PROTECTION AGENCY'S HIGH-LEVEL
WASTE DISPOSAL STANDARDS

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PUBLIC MEETING

Nuclear Regulatory Commission
One White Flint North
Rockville, Maryland

Tuesday, November 21, 1989

The Commission met in open session, pursuant
to notice, at 9:00 a.m., Kenneth M. Carr, Chairman,
presiding.

COMMISSIONERS PRESENT:

KENNETH M. CARR, Chairman of the Commission
THOMAS M. ROBERTS, Commissioner
KENNETH C. ROGERS, Commissioner
JAMES R. CURTISS, Commissioner

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STAFF SEATED AT THE COMMISSION TABLE:

SAMUEL J. CHILK, Secretary

WILLIAM C. PARLER, General Counsel

JAMES TAYLOR, Acting Executive Director for Operations

ROBERT BERNERO, NMSS

SETH COPLAN, NMSS

ROBERT BROWNING, NMSS

DANIEL FEHRINGER, NMSS

DOCTOR HERBERT KOUTS, Defense Nuclear Facility Safety
Board

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

9:05 a.m.

CHAIRMAN CARR: Good morning, ladies and gentlemen.

Nuclear Waste Policy Act of 1982 directed the Environmental Protection Agency to promulgate generally applicable standards for protection of the general environment from off-site releases from radioactive material in high-level waste repositories.

EPA promulgated these standards in 1985, but portions of the standards were vacated in 1987 by a U.S. Court of Appeals. In August 1989, the Commission requested the staff to advise the Commission of the status of EPA's high-level waste disposal standards development and the NRC staffs reevaluation of its views on implementation of probabilistic standards.

The Commission also asked the staff to report on the status of the reevaluation the use of such quantitative standards by development of procedures and rules needed for implementing the standards. The purpose of today's meeting is to hear from the staff on these matters and to discuss staff's request to pursue a continuing evaluation of the EPA standards through interactions with the EPA staff and through NRC rulemaking.

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1 At the suggestion of Commissioners Curtiss
2 and Roberts, we will also hear from Doctor Herbert
3 Kouts. Doctor Kouts has previously served as Director
4 of Research at the Nuclear Regulatory Commission,
5 Chairman of the Department of Nuclear Energy at
6 Brookhaven National Laboratory and is currently
7 serving as a member of the Department of Energy's
8 Defense Nuclear Facility Safety Board. Doctor Kouts
9 has a wealth of experience in the application of
10 probablistic techniques and the Commission appreciates
11 his willingness to share his views on this important
12 subject.

13 Copies of the presentation slides should be
14 available at the entrance to the meeting room.

15 Do any of my fellow Commissioners have any
16 opening comments?

17 If not, Mr. Taylor, you may proceed.

18 MR. TAYLOR: Good morning, sir. With me at
19 the table from staff are, to my immediate left, Bob
20 Bernero and Bob Browning. To my right, Seth Coplan
21 and Dan Fehringer, all from NMSS. Mr. Bernero will be
22 the principal briefer this morning.

23 I would like to make two points before
24 proceeding with the briefing. My first point is that
25 this is the first staff briefing since your recent

1 discussions concerning the quality of staff briefings
2 and we have tried to incorporate the comments and
3 instructions in what we will do today.

4 My second point regards the content of the
5 briefing itself. As you noted, we're concerned here
6 with an important issue, interfacing with the
7 Environmental Protection Agency. In this case, as you
8 noted, the issue is whether an EPA environmental
9 standard for high-level waste disposal which utilizes
10 probabilistic values is in a form which can be used
11 effectively in the NRC licensing process.

12 As you will note from the paper provided,
13 the answer to that is not a simple yes or no. We have
14 provided a lengthy discussion on the subject in the
15 paper provided you and you outlined our recommendation
16 of plans to pursue a long-term, ongoing evaluation of
17 the standards, both by close contact with EPA to
18 resolve implementation issues for these standards, and
19 to further resolve these issues in NRC's own
20 implementing rulemakings.

21 For this briefing, Mr. Bernero will not
22 completely review the elements of the Commission
23 paper, but will emphasize the bases and elements of
24 the EPA standards, NRC concerns with their application
25 and a reiteration of the staff recommendation.

1 Mr. Bernero?

2 MR. BERNERO: Thank you, Mr. Taylor.

3 I'd like to add note of the presence of one
4 other person. Daniel Egan, the principal author of
5 the EPA standard, is in the audience because of the
6 obvious interest in the matter.

7 (Slide) May I have slide two, please?

8 In the outline we have in your slide
9 package, I just want to note one thing. That is that
10 I think it's useful if at the outset we add something
11 that isn't in the paper we submitted to you on the
12 underlying basis of the high-level waste standards. I
13 think it will be useful in the reflections on the
14 content of the paper.

15 (Slide) May I have slide three?

16 An obvious thing when you look at it for
17 awhile is that high-level waste repositories are not
18 needed to protect present generations. For 100 years
19 or so we could easily protect the people with storage
20 of high-level waste. The high-level waste are there
21 for future generations, over the very, very long time
22 period and the underlying basis of standards for them
23 is that we project that future generations will have
24 the same bodily habits, eating, drinking and
25 vulnerability to cancer from radioactive exposure that

1 we do.

2 Therefore, when we speak of undue risk to
3 those generations, if we would quantify it, we're
4 going to talk about something like what we would
5 impose on a facility for today's releases, a ten
6 millirem per year or 25 millirem per year, certainly
7 something within the 100 millirem per year exposure
8 envisioned in the new Part 20.

9 (Slide) Now, if you go to that basis -- may
10 I have slide four -- you can do evaluations of the
11 impacts in the human environment starting with the
12 repository in the lower left there, the engineered
13 barrier systems and what gets out of it and getting
14 into an aquifer, groundwater transport. Then, when
15 you get into the accessible environment, we have a
16 long history in current facilities of analyzing
17 contamination possibilities in rivers or surface
18 waters, the food chain, getting into the different
19 pathways. But the difficulty with the high-level
20 waste repositories, we're not talking about the people
21 who live there now or who would live there 50 years
22 from now, but we'd be talking about the people who
23 might live there 10,000 years from now or 50,000 years
24 from now. That becomes an extremely complicated
25 thing, not because we don't know how to analyze the

1 food chain pathway, but because we don't know how to
2 postulate the future population and ground uses.

3 (Slide) If I could have slide five.

4 There is a more generic repository approach
5 and in the EPA standard you will find this, where one
6 can take a schematic of a repository and set it down
7 where if you look down in the repository itself, your
8 waste packages, you can have itemized standards for
9 packages, overall release standards for the engineered
10 systems, and Part 60, of course, you'll see has that.
11 And then you get into the groundwater. Then, when you
12 get to the accessible environment, you can set a
13 release limit, a source term and stop there.

14 It is a simpler standard but in order to be
15 confident that you have taken into account all the
16 groundwater and air pathways in food chains, you might
17 make a much more strict standard for that level of
18 assurance. That, in fact, is a point often made about
19 a release limit standard as being inherently more
20 conservative in order to be more simple.

21 (Slide) Now, if I could go to slide six and
22 let me just highlight the regulatory requirements we
23 have. EPA has in their standards for the overall
24 system a release standard, a source term limit. They
25 have a ten thousand year basis of calculation and they

1 state the requirement probablistically. That's the
2 heart of the controversy about the EPA high-level
3 waste standard. The subject of the remand was
4 basically the individual protection requirements in
5 groundwater that are also listed. They are of a much
6 shorter term and, as you probably know from the paper,
7 they are stated in different terms and that was the
8 basis for remand.

9 (Slide) If you turn now to slide seven, you
10 have the NRC requirements for subsystems. NRC has a
11 complementary standard to the EPA standard in that we
12 have defense in-depth performance objectives: where,
13 going back to that cartoon in your mind, we have the
14 waste package, 300 to 1,000 year lifetime. We have
15 the engineered barrier release rate, that's the 10^{-5}
16 per year after 1,000 years as a very small fraction of
17 release and the groundwater travel time of 1,000
18 years.

19 In addition, and it's a vital addition, we
20 have citing criteria and design criteria which are
21 qualitative, judgmental, good practice sort of things
22 that are needed to be there in conjunction with the
23 performance objectives. So, the NRC requirements for
24 the systems add up to a complementary approach.

25 (Slide) Now, if we look at slide eight and

1 look for pros and cons, starting with the concerns,
2 many have said that the standards, in particular, the
3 EPA standards, are unduly restrictive. By simplifying
4 with the source term the going to releases rather
5 than doses, they give up some of the margin. It
6 basically comes out, as we described in the paper,
7 we're talking about 1,000 health effects in 10,000
8 years and that's a very low level of risk carried out
9 to a very, very long period of time.

10 In the EPA standard that is stated, it is
11 really codified ALARA. It's what a good site is
12 supposed to be able to achieve. So, it is admittedly
13 going below a threshold limit sort of standard.

14 The concern, and this is a major concern, is
15 the possibility of paralyzing the regulatory process.
16 Given that there is a referenced calculation over a
17 10,000 year period so the compliance calculation is
18 for 10^{-4} years and one is forced by the words of the
19 EPA standard to consider events whose likelihood may
20 be fairly described as one chance in ten or even one
21 chance in a thousand. Intellectually, people would
22 immediately leap to it. 10^{-4} years, one chance in a
23 thousand makes it 10^{-7} . I need a geological record of
24 10^{-8} or 10^{-9} in order to make that statement, in order
25 to evaluate this thing. I'm paralyzed. I don't have

1 an adequate -- or may very well not have an adequate
2 geological record because I'm approaching the age of
3 the earth.

4 That is a very significant challenge because
5 we're dealing with processes, geological processes in
6 particular where you're looking at a geological record
7 and folding it forward to extrapolate what might
8 happen. In its most simple terms, if we have to
9 predict a scenario that is volcanic eruption or an
10 earthquake or something like that with any kind of
11 precision at a probability level of 10^{-7} or 10^{-8} , we
12 are indeed up against a formidable obstacle.

13 (Slide) Now, if I look at slide nine, there
14 are some further things I won't dwell on, concerns
15 about the standards where the terminology is not the
16 same. That often happens and you should be aware that
17 terms like "anticipated events," or "undisturbed
18 performance," need a certain discipline to make sure
19 that our standard and their standard are indeed
20 talking about the same intent, the same meaning for a
21 given term. And the treatment of human intrusion is
22 quite difficult because it is even less quantifiable
23 than some of the other things.

24 (Slide) If I could turn to slide ten, in
25 contract to the concerns, there are some perceived

1 favorable features. The release limit, of course,
2 does simplify the standard by eliminating the whole
3 food chain pathway and population projection
4 uncertainties. Having a compliance calculation based
5 on 10,000 years, this is not to say that you don't look at
6 50,000 years or longer periods, but that the reference
7 for compliance is a 10,000 period. That is a
8 favorable simplification. Of course, if you go into
9 the existing standard in the probabilistic portion, you
10 will find the phraseology similar to Part 60,
11 "reasonable expectation of the outcome," "to the
12 extent practicable," "quantifying things." It's not
13 proof in the ordinary sense of the word. You will
14 find qualifications that enable a judgmental use of
15 these probabilistic calculations and, of course, there
16 is some guidance, especially on human intrusion.
17 These are the favorable features of the standards.

18 (Slide) Just touching briefly in slide 11,
19 both standards are up for revision, EPA standard
20 because of the remand, and the NRC standards -- we
21 gave you a paper about a year ago, SECY-88-285, in
22 which the high-level waste rulemaking strategy was
23 laid out. One of the key parts of it was all of the
24 pieces of amending our standards to what it takes to
25 implement the EPA standard and incorporation of the

1 EPA standard and related matters. So, both of these
2 are on the table for revision.

3 (Slide) Now, I have slide 12 which talks
4 about the need for performance assessment. But
5 perhaps if we'd best go to slide 13.

6 (Slide) We're talking about a performance
7 assessment, some comparative probabilistic risk
8 analysis in reactors. It's not so broad or so diverse
9 a science. If you look at it, it is roughly analogous
10 to the containment performance assessment in reactor
11 PRA. There are no complex servomechanism subsystems,
12 fluid systems, electrical systems here. So the whole
13 core melt frequency or severe core damage frequency
14 part is not relevant to performance assessment for
15 high-level waste. Then, of course, if you simplify,
16 the consequence analysis is not here. You're
17 calculating a source term and basically you're dealing
18 with containment event tree sort of matters,
19 phenomenology. In the reactor, you're talking about
20 whether core concrete interaction has certain
21 characteristics. Here you're talking about
22 geochemistry and things like that.

23 But one of the difficulties we have, and
24 it's a pervasive difficulty, is performance assessment
25 in high-level waste is going over this very broad time

1 horizon and drawing in much less certain phenomena.
2 The core melt phenomena are uncertain because they're
3 so hard to duplicate experimentally and to get
4 meaningful data out of them. The uncertainty in the
5 high-level waste comes from the source prediction out
6 over 10,000 years or 50,000 years and we don't have a
7 very strong database for that.

8 (Slide) So let me turn now to slide 14 and
9 look specifically at the key probabilistic requirement
10 out of the EPA standard. The table is simplified. If
11 you go to the paper or, even better, to the EPA
12 standard, you'll see that this release limit in curies
13 is pro rata. It's per thousand tons of heavy metal.
14 So, if you're looking at a repository like Yucca
15 Mountain, the overall release limit would be roughly
16 70 times this table value because Yucca Mountain has
17 projected to hold 70,000 tons of waste.

18 The base of calculations for these releases
19 is, as I said before, 10,000 years. So, the
20 implementation of the standard uses that as a
21 compliance reference but does not preclude looking at
22 the longer time period for the perspective it provides
23 and, indeed, in DOE's site screening analyses, they
24 have looked at those longer time periods and we would
25 expect to look at the longer time periods in the

1 licensing review, although there's no compliance level
2 associated with them.

3 Now, a key thing, and I've reworded it
4 slightly down in the bottom of the slide, we're
5 talking about the probablistic nature and you could
6 really divide events with adjectives and adverbs. You
7 could say, there are likely events. There are
8 unlikely events which are nonetheless considerable,
9 worthy of consideration. And then there are unlikely
10 events so unlikely as to be negligible.

11 The EPA standard uses a numerical adjective,
12 I would call it, where they describe likely events as
13 anything having as much as one chance in ten of
14 occurring. I've written it as probability of 1.0 to
15 0.1. Their second category, excluding the first
16 category, of course, would be --

17 COMMISSIONER ROGERS: Excuse me. You said
18 "as much as." You mean more than.

19 MR. BERNERO: Yes. Yes, as much as one
20 chance in ten or more than one chance in ten, yes.

21 Now, this second category, unlikely but
22 worthy of consideration, they describe as having as
23 much as one chance in a thousand and, of course, up to
24 one chance in ten likelihood. I wrote it as .1 to
25 .001. And then, by implication, anything less likely

1 than one chance in a thousand is off scale. It's not
2 worthy of consideration.

3 The alternatives that immediately leap to
4 mind are do we need to have the number or could we
5 have just the adjective? Would that make this a more
6 robust standard? Would that make the litigation of
7 this standard in the licensing process more clear and
8 more efficient? That's an obvious question and that
9 is part of the question we have right here.

10 (Slide) Now, slide 15 is merely a graphical
11 representation of that. I would rather go to slide
12 16 --

13 COMMISSIONER ROGERS: Excuse me, just on
14 that. It wasn't clear to me what EPA ratio means.

15 MR. BERNERO: Oh, EPA ratio is just a way of
16 saying that consequences --

17 (Slide) Put up slide 15, please, Karen.

18 If you look at the rectilinear line on this
19 chart, the first vertical bar above 1.0 is that any
20 event having a probability of 1.0 down to .01 has an
21 EPA ratio of one, namely a release identical to the
22 table or less. So, the ratio of the calculated
23 release to the allowed release is one. Then, in the
24 EPA standard, they permit for the less likely events
25 which are the next vertical bar to the right running

1 from 10^{-1} to 10^{-3} . Then that vertical bar permits up
2 to ten times the authorized release.

3 So, we use as a quick description of the
4 consequence is an EPA ratio: of one is the authorized
5 source term for normal events or likely events and
6 then any other EPA ratio would fall above it or below
7 it as a description of the level of consequences.

8 CHAIRMAN CARR: That's clear to me. What's
9 the second line on that chart?

10 MR. BERNERO: Well, the EPA standard is
11 actually described by those two vertical lines.

12 CHAIRMAN CARR: Yes.

13 MR. BERNERO: And the second line, the
14 curve, would be a hypothetical repository. When you
15 calculate it, you would expect to get a curve of that
16 general shape. If you ever look at a CCDF, a
17 complementary cumulative distribution function for a
18 reactor PRA, you will get a probability versus
19 consequence plot just like this with a similar shape
20 to the curve. They're generally concave downward.

21 CHAIRMAN CARR: But the location of that
22 curve doesn't have any meaning?

23 MR. BERNERO: Oh, yes, it does in this case,
24 to illustrate --

25 CHAIRMAN CARR: Except it's under the line.

1 MR. BERNERO: -- it would be acceptable.

2 MR. TAYLOR: It's just an example,
3 hypothetical.

4 MR. BERNERO: Yes. It would be acceptable.

5 CHAIRMAN CARR: Okay.

6 MR. BERNERO: (Slide) Slide 16 really puts
7 on what in any standard system are the questions you
8 have to confront in doing a licensing review for a
9 repository. What can go wrong with this repository?
10 Obviously, you're selecting a site that's very normal,
11 very stable, very deep. You want a high degree of
12 isolation but you are forced by the nature of the
13 safety review to ask what can go wrong and what are
14 the consequences if it goes wrong, if some fissure
15 opens up, splitting the repository in two or a volcano
16 or a groundwater travel change of some sort.

17 Sooner or later, you've got to confront
18 question number 3, how likely? How do you state it?
19 Do you address it numerically or qualitatively? That
20 takes you back to what I said. You can have likely,
21 unlikely but considerable and so on, or you can have
22 describable as at least one chance in ten, describable
23 at least one chance in a thousand.

24 (Slide) Now, let's look at an example
25 repository. Slide 17 is a table. Let me walk through

1 it. It's not in the paper. I think it will be
2 useful. A real repository is going to have far more
3 scenarios than this. Even if you consolidate the
4 scenarios, I would expect to have at least a dozen
5 scenarios on a real repository. But let's hypothesize
6 a repository safety analysis where we have a baseline
7 or normal condition. That's the expected
8 configuration. That's the way we would leave it post-
9 closure. Then we have two upset conditions, a fault
10 movement, some seismic event, and a volcanic event.
11 Again, these are hypothesized values. This is not a
12 real repository.

13 We've got a compliance calculation over
14 10,000 years and we look at the likelihood and these
15 multiple significant figures for the baseline don't
16 imply precision, they just mean they are the
17 difference between likelihood and the unlikely events.
18 So, they're virtually a likelihood of one. We have
19 for this hypothetical repository an EPA ratio of 0.1.
20 So, on that grounds, that repository would be clearly
21 acceptable. It's roughly an order of magnitude lower
22 than the standard permits.

23 If we look at this hypothetical fault
24 movement, we put in an asterisk just to make sure that
25 there would be no doubt about it, it's a conservative,

1 upper-bound estimate for that one and you can exclude
2 it from further consideration because even at a
3 conservative upper-bound, it comes out with an EPA
4 ratio of one, but it is an upset condition and merits
5 permitting ten times the EPA standard so it's not
6 limiting. Then we look at this other upset event,
7 volcanic event, and we've got a debate. People are
8 saying it's one chance in 1,000 or one chance in
9 10,000 and if we look at the consequences they could
10 be 100 times the EPA standard level, whereas an upset
11 condition by the standard should only be ten times.
12 So, this would be a ten-fold exceedance of the EPA
13 standard.

14 Now, at this probability, this event could
15 be in or out of the debate. So, what this analytical
16 process has done now with this hypothetical
17 repository, it's focused our attention on the
18 performance assessment of the volcanic upset condition
19 as the crucial probability, the crucial issue.

20 (Slide) Now, if we turn to slide 18, I'm
21 going to deliberately --

22 CHAIRMAN CARR: Hypothetically, of course.

23 MR. BERNERO: Yes. But I'm deliberately
24 using here John Trapp's note of earlier this year.
25 You know, our senior geologist wrote this healthy

1 skepticism note and said, "Hey, if I do model A and
2 model B," and this is a summary of what he was doing
3 on slide 18, there were two models or two alternate
4 hypotheses to describe volcanism. In the early '89
5 period -- since that time DOE has evolved and they've
6 got a lot of investigative program going on now, but
7 in the early '89 period you could say, model A
8 represented the DOE baseline model for volcanism
9 and model B was the State of Nevada's consultant
10 model.

11 Notice the difference. The one, the more
12 optimistic model A says there was a single eruption
13 that formed these volcano cones that are evidently
14 there and we're at the tail end of the volcanic cycle.
15 So things are quieting down.

16 The alternative model, in contrast, says,
17 no, these are multiple eruptions and it's a cyclic
18 thing. It's still going on. Well, if you graphically
19 represent it --

20 (Slide) Now, slide 19, you're better off
21 looking at it in your slide package than on the screen
22 if you want to look at any of the print because we had
23 to photo reduce it to get it on the screen. But
24 really, this is a graphical representation of the
25 alternate conceptual models that we just talked about.

1 First of all, the rectilinear line up at the top is
2 once again the EPA standard and you're looking for
3 analytical results that fall in the region below the
4 standards.

5 Now, if you take model A, which is the lower
6 box, and look at the parameters that enter into model
7 A evaluations. By that I mean quantifying on the data
8 available how big is the magma field, how old are the
9 cones, all the different factors. We discuss some of
10 them in the paper. If you quantify the range, you're
11 going to get a variation in consequence and you're
12 going to get a variation in probability, therefore
13 some sort of a box or trapezoid to describe the range
14 of outcomes.

15 Well, the model A box is well below the
16 standard. The model B box, which is less sanguine,
17 exceeds the standard in that region that you see
18 sticking up the bold, black line, up above it. So,
19 what happens now? We have an apparent exceedance of
20 the standard and the issue can be addressed, are we
21 dealing with the probability number explicitly or are
22 we dealing and would the litigative process go to the
23 underlying scientific bases for model B? How well do
24 you know the age of the cone? How well do you know
25 the size of the magma field? How well do you

1 scientifically characterize the cyclic nature, the
2 recurring nature of this volcanism?

3 So, that's the real issue with the standard,
4 whether the presence of the probability consequence
5 discipline, using that as a discipline for analysis,
6 whether the process will become paralyzed with the
7 numbers or the process will instead use the numbers as
8 a discipline to focus on the science. Of course, the
9 objective is to do the latter, to focus on the
10 science.

11 (Slide) May I have slide 20?

12 In the paper, we gave you four alternatives.
13 Evidently, you could even go into the alternatives and
14 make subalternatives of them. In essence, we're aware
15 of the opinion that has been voiced recently about
16 leave this part of the EPA standards alone and let's
17 just do implementation in our standards, the
18 deliberation in our standards. That is a subvariation
19 that could go in here, leaving the current EPA
20 standards, except for the remanded part. But
21 basically, what the staff is recommending, the staff
22 is recommending that we go with alternative 3 which
23 not only looks at substantive revision of Part 60 in
24 order to implement and clarify how the EPA standard is
25 used, but looks toward very active interaction with

1 EPA so that the optimum implementation treatment and
2 qualifications are incorporated in the EPA standard
3 prior to its repromulgation. That's basically what
4 we're saying.

5 In contrast, alternative 4 is the most
6 extreme alternative and that would be for the NRC to
7 take a different tact altogether and try to shy away
8 from the EPA standards altogether and go essentially
9 with a revised Part 60 to be the sole basis in hearing
10 of whether or not the site is acceptable.

11 (Slide) So, if I turn to slide 21, the
12 staff feels that given this good interaction with EPA
13 in the repromulgation process and appropriate
14 rulemaking and implementation work on our own
15 standards, that we can achieve a useful
16 probablistically based standard that won't paralyze
17 the regulatory process and that will be a useful
18 illumination of the high-level waste safety decisions
19 in that process. Therefore, that's what our
20 recommendation is and we leave it to you to endorse
21 that.

22 I'd be happy to answer any questions and
23 staff here, of course, is expert in this and has been
24 involved in it for years, going back to the earlier
25 controversies and we'll be happy to recover any of

1 that history you'd like.

2 CHAIRMAN CARR: That's it?

3 MR. TAYLOR: That's it, sir.

4 MR. BERNERO: Yes.

5 CHAIRMAN CARR: Any questions, Commissioner
6 Roberts?

7 COMMISSIONER ROBERTS: No.

8 CHAIRMAN CARR: Commissioner Rogers?

9 COMMISSIONER ROGERS: Well, yes, I've got a
10 lot of questions. We'll be here all day, I think.

11 First, some general questions. Is there a
12 master list of basic underlying assumptions for these
13 standards? Has anybody written down what the
14 assumptions are behind each of these standards? Some
15 of them are -- it's fairly obvious and some may not be
16 so obvious.

17 For example, it seems to me that the focus
18 with respect to human factors is the very negative
19 aspects of human intrusion into a site. What about
20 positive human intervention? The assumption seems to
21 be here that future generations are going to be
22 technologically impotent. Why don't we write that
23 down if that's really what's behind it?

24 MR. BERNERO: Well, I think it's fair to say
25 that there is no master list, but you will find in

1 places some illumination of it. Now, one of the
2 reasons I put that underlying basis in the
3 presentation is that would be one of the assumptions,
4 that we assume future generations are equally
5 vulnerable to cancer.

6 In the human intervention arena, we have
7 just recently discussed as one of the needs is to get
8 assumptions. For instance, if future generations are
9 sufficiently smart that they can drill deeply into a
10 geological formation, should we assume they're equally
11 smart enough to recognize radioactive contamination
12 when they hit it? That's an underlying assumption
13 that would clarify the basis of the standard for human
14 intervention.

15 COMMISSIONER ROGERS: Well, it would seem to
16 me that it would be very helpful to understand what
17 these really are because they're quite important and
18 they're not at all clear and they're very fundamental
19 with respect to some of these issues.

20 MR. BROWNING: I think the statement of
21 considerations connected with each of the rulemakings
22 is the place where in the case of the EPA standard,
23 EPA laid out what the basic assumptions are beyond
24 their rule. So, that would be the source of
25 information. The same thing would apply for our

1 roles.

2 COMMISSIONER ROGERS: Well, it would be nice
3 to see those, frankly.

4 MR. TAYLOR: We can put that together and
5 get it to the Commission.

6 COMMISSIONER ROGERS: I'd very much like to
7 see what our analysis is of what the underlying
8 assumptions behind these standards are and whether,
9 when they're all written down, EPA agrees that that's,
10 in fact, what they were assuming. Maybe not. I'm
11 rather concerned about this. It seems to me that
12 we're dealing here with a very, very difficult
13 situation, partly difficult perhaps because we're
14 making certain assumptions that we haven't really
15 clearly agreed upon that those really are what we
16 believe to be the situation.

17 It's very nice to say that we believe future
18 generations are going to be the subject to all the
19 failings and frailties of current generations, but why
20 don't we assume that they also have some of the skills
21 and smarts that the present generations have? We seem
22 to have turned off on that one. I'd like to
23 understand that a little bit better.

24 So, that's a concern that I have that would
25 give me a lot more comfort if I felt we all understood

1 exactly what we're talking about here. There's so
2 much emotion and so much division on this whole
3 question, I wonder if we could at least write things
4 down that we commonly agree on or what we -- this
5 basic starting plan for construction of these
6 statements. If the NRC is going to have to write
7 regulations that have to be imposed to satisfy those
8 standards, then at least we ought to understand what
9 it is that -- where we're coming from and where the
10 standards came from.

11 So, I'd like very much to see that, if it
12 could be done, and to see to what extent the EPA
13 people agree that that's exactly what the assumptions
14 are. You get them up to expose them to the full light
15 of day.

16 MR. BERNERO: Yes. I think it would be very
17 useful if we did a broad summation of all those and
18 identify where there is consensus and where there is
19 controversy.

20 COMMISSIONER ROGERS: Yes. So, some of
21 these things, it seems to me to some extent, just seem
22 to be written down but where do they really come from?
23 I'd like to see that to a greater degree than I've
24 been able to so far.

25 Talking about your approach here with

1 respect to probablistic calculations and the EPA ratio
2 and coming back to slide 19, in using this, to what
3 extent -- how are you going to deal with the
4 assumptions or uncertainties really in those
5 probability numbers themselves? We're looking here at
6 something that I haven't thought a great deal about,
7 but it seems to me that one can be somewhat deceived
8 by these graphs and what they tell you. The EPA
9 ratio, when it's above one, is really starting to get
10 into trouble. The more above one it is, the more
11 troublesome it is. Then you have this question of how
12 low a probability do you consider for something that
13 has a very high EPA ratio, and then what are the
14 uncertainties in the calculation of that probability?
15 So, what's the error band of this thing that one
16 should be --

17 MR. BERNERO: If one had a very precise
18 algorithm, that hypothetical chart that just had the
19 sloping line, that would be the central estimate or
20 the median or whatever it is and there would be an
21 error band on it, there would be two shadow curves,
22 one above and one below, to indicate the uncertainty.

23 In actuality, the EPA standard is much more
24 simplistic. It's just two criteria boundaries. These
25 squares are not really representative. They would be

1 a complex shape because they reflect a simple
2 graphical presentation of the range of uncertainties
3 within that model. So, given the hypothesis as in the
4 fine print on slide 19, we're in a monocyclic,
5 volcanic regime and we're at the end of the cycle,
6 then all of the parameters that come into it give me
7 this kind of a range in probability and this kind of a
8 range in consequence and in this particular case it
9 comes out, I don't have to worry about the precise
10 shape of the thing because I don't encroach on the
11 standard. I'm well within the standard's permission.

12 But with model B, I have to get more serious
13 and say, what are those uncertainties or what are
14 those variations that bring me up to the level of
15 concern or limit by the standard and then I still have
16 the words of the standard that the ultimate judgment
17 of undue risk is, is there a reasonable expectation
18 that even under these upset conditions that I
19 envision, that this site and repository will be
20 acceptable.

21 So, that exceedance there has to be --

22 COMMISSIONER ROGERS: Well, I think that's a
23 good way to look at it. But another way to look at it
24 also is that what you're talking about, and tell me if
25 I'm wrong here, on models A and B that the centroid of

1 A and the centroid of B are both below the curve.

2 MR. BERNERO: Yes, they could well be. In
3 fact --

4 COMMISSIONER ROGERS: I'm just assuming some
5 kind of a step function distribution here to give you
6 this square box.

7 MR. BERNERO: Yes.

8 COMMISSIONER ROGERS: So that the centroid
9 of B is well below the curve and is acceptable and
10 it's that little overlap area out there that you have
11 to look at.

12 MR. BERNERO: Yes. And where I have to
13 exercise the judgment which says, can I tolerate those
14 uncertainties and still say there is a reasonable
15 expectation that the site will perform acceptably?

16 CHAIRMAN CARR: But couldn't -- can I
17 piggyback a minute?

18 COMMISSIONER ROGERS: Sure.

19 CHAIRMAN CARR: It looks to me like that B
20 is "generally applicable," which is what the standards
21 were supposed to be. It doesn't say it has to be
22 applicable everywhere. It says generally applicable.

23 MR. BERNERO: I'm not sure I follow you.

24 CHAIRMAN CARR: That's what the law says,
25 that they're supposed to make standards that were

1 generally applicable.

2 MR. BERNERO: Oh, yes. Their line, the
3 heavy bold line that has the zig-zags in it is the
4 standard.

5 CHAIRMAN CARR: Yes, but --

6 MR. BERNERO: B is the hypothesized
7 perform --

8 CHAIRMAN CARR: B generally meets that
9 standard.

10 MR. BERNERO: Yes. One might argue, it
11 depends on where the centroid is. We don't have the
12 data to do a more precise analysis, but one could
13 conclude that generally applicable or, the way I put
14 it, there is a reasonable expectation that it meets
15 the standard.

16 CHAIRMAN CARR: Yes. I didn't read that it
17 says that you have to meet it in every specific thing
18 you can think of.

19 MR. BERNERO: That's right.

20 CHAIRMAN CARR: Excuse me.

21 COMMISSIONER ROGERS: No, that's fine.

22 Well, just coming at this whole question of
23 probabilistic standards, I know there's been a great
24 deal of discussion about that and I'm not comfortable
25 that we have really come to a total position on how we

1 feel about these probablistic standards. I know just
2 within the last six months or so the kind of
3 impression that I've gotten of staff feeling about the
4 probablistic standards are that they're very difficult
5 to deal with and at one point some people have said,
6 well, they're almost impossible. And now we're
7 beginning to hear that, well, we feel that we can deal
8 with them.

9 But I wonder if we could just talk a little
10 bit about that. In coming to a set of probablistic
11 standards, did EPA consider alternatives to that? Do
12 you know what they considered? Did they -- how did
13 they come to a probablistic standard versus, say, a
14 more deterministic approach?

15 MR. BERNERO: Seth, would you or Dan like to
16 speak to that one?

17 MR. COPLAN: Let me start. I think Dan has
18 had pretty extensive involvement with the EPA over the
19 years, so let him elaborate.

20 But the approach that EPA took in terms of a
21 probablistic standard is something that they started
22 quite a few years ago. I think there were working
23 drafts going back, to my knowledge, as early as 1979
24 that had this basically probablistic flavor to them.
25 At that time, the Commission staff was really pretty

1 strongly in disagreement with that type of approach.
2 We tried to encourage EPA to develop standards that
3 addressed this issue of likelihood of upset conditions
4 in a more qualitative way. We also tried to have them
5 focus on things on an individual scenario basis rather
6 than collectively in the form of this curve that
7 brings together both normal conditions and upset
8 conditions.

9 I think what was really part of, in a way, a
10 telling consideration over time to us is that EPA was
11 looking at the standard in a way as if you had
12 somebody standing at the edge of the accessible
13 environment, collecting radioactivity over a 10,000
14 year period. They were putting a standard on that
15 and, as Mr. Bernero described, they were focusing on
16 the radioactivity as a surrogate for dose in an effort
17 to kind of simplify what we'd have to deal with.

18 So, you have this guy, he's standing at the
19 edge of the accessible environment collecting
20 radioactivity for 10,000 years. On average, he would
21 be collecting normal scenario types of releases, but
22 also in a certain sense there would be some upset
23 conditions. What they were figuring is kind of
24 weighing it in on the basis of the frequency of
25 occurrence or probability that these events would

1 have. I think over a period of time, the staff that
2 were most directly involved with EPA began to become
3 convinced that perhaps this was a good way to
4 establish a standard and I think with some of the
5 points, again, that Mr. Bernero made about how if you
6 keep the focus on the scientific basis for the
7 numbers, that it would probably provide also a good
8 discipline for doing the licensing.

9 Dan, would you want to add anything?

10 MR. FEHRINGER: Yes. I'd like to emphasize
11 that there was a great deal of interaction between the
12 NRC staff and EPA staff on exactly this point, is a
13 numerically probabilistic standard workable or would
14 some alternative be preferable?

15 We spent a great deal of time and effort
16 trying to conceive and articulate an alternative that
17 was clearly preferable and we could not find one. The
18 best alternative we were able to come up with was what
19 Mr. Bernero alluded to, get rid of the numbers and use
20 words instead, words like "likely," and "unlikely."
21 What you gain in flexibility, you lose in precision
22 when you have a standard expressed that way and we
23 didn't see that the tradeoff was clearly beneficial in
24 that case.

25 CHAIRMAN CARR: Let me piggyback on that one

1 too.

2 Has anything changed since the NRC developed
3 the rationale for Part 60 and NUREG CR-235 to make us
4 now doubt the implementability of EPA's current
5 containment standards? What's new, I guess, since we
6 decided we could do it this way?

7 MR. COPLAN: I think that the one thing that
8 is new is, of course, there's been more experience in
9 dealing with real sites. The standards were based by
10 doing calculations on hypothetical sites. Since this
11 earlier period when the standards were taking form,
12 there has been more direct investigation of the WIPP
13 site, of Yucca Mountain site, the Hanford site. So
14 there's been some experience and a recognition that
15 certain things might be a good bit more complicated
16 than the hypothetical sites would lead one to believe.

17 However, I think also at the time that the
18 standards were developed, there was a recognition that
19 these hypothetical sites were oversimplification. So,
20 I think what we're finding at this point is that, yes,
21 there are going to be some difficulties when you get
22 down to really trying to figure out how, say, this
23 volcanism situation works well enough to start putting
24 numbers around it. But at the same time, I think that
25 on balance we still think we can do it.

1 MR. TAYLOR: I'd like to add and perhaps Bob
2 would too --

3 MR. BERNERO: Yes.

4 MR. TAYLOR: -- that I think Seth said it,
5 but I'll say it again. We've had much more experience
6 dealing in the PRA arena in intervening years. That's
7 a fact. And on the reactor side where we've been
8 working hard, as you know, for many years, studies
9 like NUREG 1150 and so forth, the work in progress has
10 increased the staff's understanding of the
11 applications and even in that arena the external
12 events and remote type events such as seismic events
13 of great magnitude have, I would say, increased the
14 staff's appreciation of the range of predictions by
15 expert opinion and its effect on probabilistic
16 distributions.

17 Bob, have I tried to capture maybe the --

18 MR. BERNERO: Yes. I'll pick up on that.
19 As you know from NUREG 1150, the codification of
20 expert opinion, very controversial, very difficult,
21 and recall that I made the comparison in the
22 briefing -- performance assessment is very much like
23 containment performance assessment, very difficult
24 part of reactor PRA. But I would like to go back.
25 That gives you proper and due caution.

1 But nevertheless, what Seth said earlier is
2 worth repeating and perhaps another way. From time to
3 time in history, a panel of experts can be drawn
4 together and they will say that deep geological
5 disposal of high-level waste is technically feasible.
6 If you get that panel of experts and say, "Is this
7 high level waste acceptable in that hole in the
8 ground," they suddenly start to agonize over the
9 decision. I think there's a very large part of that
10 too.

11 So, we have this experience on the reactor
12 side that has entered in and made us a lot more
13 cautious about quantifying expert opinion and, at the
14 same time, we've got a lot more site specific
15 information. We've got these slides that, here's the
16 volcanos at Yucca Mountain. Let's talk about them and
17 not some hypothesis. So, you get a lot closer to the
18 decision.

19 COMMISSIONER CURTISS: Let me pursue that
20 just for a minute because I guess one of the things
21 that troubled me about the paper was what appeared to
22 be some tension between a couple of schools of
23 thought.

24 What you've described here is a conclusion
25 that the Agency had reached pretty much in '85, that

1 the probablistic, quantitative EPA standard can, in
2 fact, be implemented so long as we understand that
3 what we're seeking here is reasonable assurance and
4 not expecting proof in the ordinary sense of the word
5 in our proceedings. So, we had reached that point in
6 '85 and the language reflected reasonable assurance
7 and proof in the ordinary sense was incorporated in
8 both the EPA standard and the 10 CFR Statement of
9 Consideration.

10 I guess the question that I have at this
11 point, given your recommendation, it does indeed
12 appear to me that you are less confident today of your
13 ability to demonstrate compliance with the EPA
14 standard if you take a look at the recommendation that
15 you're making. What you're essentially saying is, if
16 I distill it to its essence, is that assuming no
17 change in the containment criteria in the EPA
18 standard, that we need to go back to EPA and secure
19 additional clarification of a qualitative nature, work
20 something out with EPA that would clarify to a greater
21 degree than we did in 1985 and with emphasis upon
22 qualitative considerations just how it is that you
23 would meet this probablistic standard.

24 Now, for that reason, and the tension that I
25 guess I detected in the paper was one that seemed to

1 suggest that because of the emphasis on the need for
2 further qualitative guidance on the implementation
3 beyond what we reached agreement on in '85, it
4 appeared to me that you were moving away from as much
5 reliance on the probablistic approach as you
6 envisioned in '85. Can you clarify that for me?

7 MR. BERNERO: I'd like to speak to that. I
8 tried to cover it in the briefing and perhaps not
9 adequately. There are two sources of tension that
10 should be apparent in the paper and apparent in the
11 alternative.

12 On the one hand, there is the question of
13 whether the existing words of the implementation
14 character of the probablistic EPA standard, the
15 reasonable assurance, reasonable expectation, the not
16 proof in the ordinary sense of the word and so forth,
17 whether those are sufficient qualifications to avoid
18 numerical paralysis of safety review or whether know
19 some better, some much more knowledgeable
20 qualifications based on specific consideration of how
21 to implement the standard, the sorting of events, the
22 quantification of human intrusion and the very real
23 problems, whether better qualifications or more
24 specific implementation language in the EPA standard
25 is needed. But notice, in both cases it's a

1 probablistic standard.

2 COMMISSIONER CURTISS: I understand that.
3 But --

4 MR. BERNERO: So there is that tension and
5 at the same time there is a real tension of those who
6 say, "Are you sure you can succeed and should you not
7 go to alternative 4," and say you aren't going to get
8 there from here, you've got to go out of probablistic
9 space into bounding analysis, judgment, a much more
10 deterministic analysis.

11 CHAIRMAN CARR: But if you ask that
12 question, you may not like the answer. Currently, it
13 looks to me like you've got a lot of leeway. Your
14 statement in the paper says NRC is responsible for
15 licensing the disposal repository but it's licensing
16 judgment must be based on compliance with the EPA
17 standards. But when I read it, it says but its
18 licensing judgment must be not inconsistent with the
19 EPA standards. That's what we're required to be is
20 not inconsistent. That's a lot of leeway.

21 MR. BERNERO: Well, you could go back. In
22 fact, I don't know if you had a chance to have your
23 staff look at the -- you asked a question about the
24 underlying basis if Part 60. There is a detailed
25 analysis in whatever SECY paper that was four years

1 ago that talks about our present Part 60 with the
2 linkage of basically three deterministic performance
3 tests with a set of judgmental good geological
4 qualities and bad geological qualities and design
5 criteria. That mixture might, in itself, be
6 sufficient.

7 If you go to that analysis of Part 60, it
8 basically shows an analysis to establish reasonable
9 confidence that this Part 60 does indeed hold out a
10 reasonable promise of satisfying the EPA standard.
11 One is at the edge though of saying, "Could I say with
12 assurance that I don't even have to do the performance
13 assessment of the EPA standard," in other words, the
14 probabilistic display, "that I could use only the
15 deterministic and judgmental."

16 If you look at that analysis, I'm afraid
17 that the parameters of deep geologic disposal are not
18 so free or not so forgiving. I think you would end
19 up, if you look at that data and I was pondering this
20 myself some time ago, that you would end up not with a
21 1,000 year groundwater travel time, but a 10,000 year
22 groundwater travel time. You would not end up with a
23 10^{-5} per year release fraction, but something more
24 like 10^{-6} . And the same thing with the package
25 lifetime.

1 In order to have that kind of confidence
2 that you could virtually go to alternative 4, you'd
3 have to go so conservatively that you might rule out
4 all the good sites.

5 COMMISSIONER CURTISS: Let me make sure I
6 understand what you're saying.

7 CHAIRMAN CARR: I'm not sure -- I don't
8 agree with that statement, but I understand it.

9 COMMISSIONER CURTISS: Are you saying that
10 if you demonstrate compliance with the subsystem
11 performance criteria, that with the exception of the
12 margin question, that you have complied with the EPA
13 standard?

14 MR. BERNERO: No. If you go to the backup
15 for the promulgation of Part 60, it says -- it's
16 justifying a regulation which says, "Here are
17 alternate ways to analyze the site in conjunction with
18 the performance assessment." So, you actually have
19 the two. You have the two together. The alternate
20 way, the Part 60 way, is a defense in depth three
21 performance elements and a complementary set of
22 judgmental qualities, good geology, bad geology and
23 things like that.

24 But the underlying basis is that you need
25 both. What I'm trying to describe is what would it

1 take to make a generic finding that if you meet the
2 deterministic standards alone, it is evident that at
3 any site you're going to meet the probablistic
4 standard. That, unfortunately -- we've talked about
5 this before. When you go to deep ocean disposal, the
6 system may be so simple and may be so forgiving, that
7 you could make such a finding, but that's
8 hypothetical. It's not a practical solution.

9 COMMISSIONER CURTISS: Let me take a
10 hypothetical. If you had a DOE application that
11 proposed 10,000 year container and 100 year
12 groundwater travel time, would that meet the EPA
13 standard?

14 MR. BERNERO: Yes, it could. Some
15 combination of a very good container and a very poor
16 site, but it wouldn't meet our standard.

17 COMMISSIONER CURTISS: Well, I guess that
18 goes back to a fundamental question that I have. That
19 is that, stated in its simplest terms, if the folks at
20 EPA are to set the standard for protection of the
21 public health and safety and were to implement that, I
22 guess I haven't understood what the relationship is of
23 the subsystem performance criteria to the EPA
24 standard. They're not questions that go to how you
25 implement the EPA standard because at that

1 hypothetical you've got a situation -- you've got a
2 proposed approach to defense in depth that would meet
3 the EPA standard, but it would not comply with the
4 requirement 60.113 that you have a 1,000 year
5 groundwater travel time.

6 MR. BERNERO: I believe we referred to it in
7 the paper somewhere. The EPA standard does have the
8 understanding or expectation that we will have defense
9 in depth without undue reliance on, let's say, the
10 package or the groundwater.

11 COMMISSIONER CURTISS: I'm not objecting to
12 the defense in depth principle. What I'm focusing on
13 is the articulation of that principle in the kind of
14 detail that 60.113 contains. There's a situation
15 where if you came in with a container that far
16 exceeded the 300 to 1,000 years that we require in
17 60.113 and you wanted to take credit for the
18 investment that you make in, say, a copper container
19 to achieve that by saying, "Because of the performance
20 of that container, I don't have to demonstrate 1,000
21 year groundwater travel time and all the complications
22 that the geological challenge associated with that
23 will pose," you can do that under the EPA standard.
24 In other words, you have met EPA's articulation of
25 protecting the public health and safety, but you

1 cannot do that or at least you're not permitted,
2 absent Commission intervention under 60.113, to do
3 that.

4 MR. BERNERO: I would prefer to ask Seth not
5 to nod his head --

6 COMMISSIONER CURTISS: He's shaking his
7 head. Did the reporter note that he's shaking his
8 head?

9 MR. BERNERO: -- to use the words you said.
10 You have demonstrated in that long-lived container
11 that you can satisfy perhaps the containment
12 requirements of the EPA standard, but it remains to be
13 judged whether those defense in depth implementation
14 factors or details that are properly dealt with by the
15 NRC in its regulation and its licensing, are fairly
16 treated. It would be in our safety analysis whether
17 we would give 10,000 years or 100,000 years credit to
18 the copper can or whatever it might be.

19 COMMISSIONER CURTISS: Well, assuming that
20 there's reasonable assurance -- and I'm stipulating
21 that for the purpose of the hypothetical -- that
22 you've got a container that can last for 10,000 years
23 and you can demonstrate that to the licensing board,
24 assuming that as a point of departure, what you are
25 saying in addressing that hypothetical is that the EPA

1 regulations can be satisfied and the public health and
2 safety can be protected in the manner that Congress
3 has charged EPA to articulate in the standards. But
4 because of the structure of 60.113, that hypothetical,
5 which does involve a mix of defense in depth, would
6 not meet our standards.

7 The conclusion that I draw from that is that
8 we have articulated or expressed in 60.113 not just a
9 framework for implementation of the EPA standards, but
10 a separate and in this case in consistent standard
11 under the rubric of defense in depth.

12 MR. BERNERO: The closest analogy I could
13 make, and perhaps it would illuminate this, go into
14 reactor land, potentially controversial. A safety
15 goal for a reactor would call for an off-site risk of
16 some low level. We are faced, and it's a very
17 difficult question, with the possibility of a reactor
18 whose likelihood of severe core damage is so low as to
19 moot the need for a containment. It's like a can, a
20 very, very good waste container and mooting the need
21 for a particularly good site.

22 The EPA standard is not so simplistic as to
23 say, "Here is a safety goal. That's all it is." It
24 has certain words in it and certain bases that require
25 you to take due account of the frailty of those

1 calculations. Our regulations and our
2 responsibilities are very comprehensive and it is in
3 that arena that we have this highly structured defense
4 in depth thing and the significant responsibility of
5 deciding where can you hedge and where do you not
6 hedge. You can go in our standards and we say, "300
7 years to 1,000 years of package lifetime." There's
8 another passage that says, "Take a look above that and
9 see whether you can exploit the package to get more
10 margin." That's part of defense in depth.

11 COMMISSIONER CURTISS: But the margin is
12 built into the EPA standard when -- as they have
13 decided that you want to have one-tenth of a health
14 effect per year, that's the margin. That's compared
15 to -- I disagree with the statement in the paper that
16 that's comparable to what we do with reactor risks. I
17 think that's just flatly incorrect. But it does seem
18 to me that the question of margin and conservatism is
19 built into the EPA standard with an approach that we
20 acceded to, not because it had a basis in some sort of
21 assessment of a risk, but because it was achievable.
22 And then to articulate that you want a separate one on
23 conservatism that is based upon the principle of
24 defense in depth that leads you to very challenge that
25 you're going to face here, demonstrate groundwater

1 travel time of 1,000 years is going to involve these
2 complications on the performance of a geologic medium.
3 Not only that, but more parochially, it gets us into
4 the need for the rulemaking initiatives uncertainties
5 when you define what groundwater travel time is and
6 what substantially complete containment is.

7 We're going to address or the staff is
8 proposing that we address a whole range of
9 uncertainties that derive from the set of subsystem
10 performance criteria when they may not have any nexus
11 to the EPA standard.

12 MR. BERNERO: I think you're presuming that
13 the margin in the EPA standard by going from a dose
14 standard to a release standard is amply available for
15 the uncertainties in the calculation. I'm not sure it
16 is. There has been concern that the release limits,
17 the margin purportedly associated with the release
18 limits, is needed to cope with the variability of the
19 standard, the dose standard implementation that--
20 Yucca Mountain has no one living there. Some other
21 site, if you came in the Eastern Seaboard with a
22 repository, you could have a fair population living
23 right around the site. What they've done is paid a
24 price for simplification. But technical analysis of
25 the EPA standard in the past has shown that simply

1 representing the release alone, if all of that release
2 came in one little rivulet of water that went to one
3 farmhouse, you could kill the people.

4 COMMISSIONER CURTISS: I agree.

5 MR. BERNERO: Or if it went into the Pacific
6 Ocean, no one would get a health effect.

7 COMMISSIONER CURTISS: But the margin exists
8 in part because Congress has selected Yucca Mountain
9 where there aren't any people living around the site
10 or a significant -- not as many as Minnesota, for
11 example.

12 MR. BERNERO: But we don't realize that
13 margin in this case, if it be there, because we paid a
14 price to go -- we collective, the U.S., by using a
15 release standard, have obviated the need to model who
16 will live at Yucca Mountain 20,000 years from now.

17 COMMISSIONER CURTISS: Yes, I understand. I
18 don't want to pursue it in a whole degree of detail
19 here. I guess the thing that puzzles me about the
20 paper and the tension that I detected is that we seem
21 to be saying in 60.113 that we do, in fact, have a
22 separate -- you've described them as complementary,
23 but the hypothetical, I think, may suggest that they
24 are, in fact a separate set of criteria, the 1,000
25 year groundwater travel time, 100,000 release rate and

1 the 300 to 1,000 container, that if you demonstrate
2 that you meet those, you don't meet the EPA standard.

3 So, in effect, we have set up in 60.113 a
4 set of standards, call them generally applicable if
5 you will, but they are a set of standards that are
6 designed to address the risk to the public health and
7 safety. That strikes me as EPA's job. Additionally,
8 the complications that we are facing today in
9 demonstrating that you meet those three subsystem
10 performance criteria, including the regulatory
11 uncertainty question, and the skewing of the balance
12 that the applicant might strike in the defense in
13 depth area, the 10,000 year container, seem to me to
14 make that -- seems to me that that's a reason to take
15 a careful look at 60.113 in the first place.

16 So, on the one hand, we've got a set of NRC
17 criteria that really do establish principles for the
18 protection of public health and safety. At the same
19 time, what the staff, I take it, is proposing is that
20 with respect to the EPA standard, we go to EPA and we
21 ask them to include additional guidance in their
22 standard qualitatively on the implementation of that
23 standard. I guess jurisdictionally, if nothing else,
24 that strikes me to be a responsibility that we ought
25 to have and not EPA.

1 So, it looks to me like maybe we've, in each
2 of those areas, taken an approach that frankly I don't
3 understand.

4 MR. BERNERO: Well, that's the tension I was
5 trying to refer to. Given that there would be these
6 two orthogonal and, I assert, complementary standard
7 systems, that the EPA standard would have further
8 details added to it that would acknowledge or
9 recognize the implementation needs or content of the
10 NRC standards and actions.

11 COMMISSIONER CURTISS: Why don't we put that
12 in our regulation as an implementation --

13 MR. BERNERO: Oh, we clearly have to. Our
14 big three rulemaking. Our big three rulemaking, how
15 do we categorize --

16 COMMISSIONER CURTISS: No, no, I'm not
17 talking about the uncertainties. I'm talking about
18 the question of how you implement the EPA standard,
19 jurisdictionally if nothing else. The EPA sets the
20 standard and we implement it. Doesn't that suggest
21 that those criteria on implementation qualitative, as
22 you're proposing, ought to be in the Commission
23 standards and they ought to be a matter for the
24 Commission, not EPA, to decide?

25 MR. BERNERO: Well, that's the view that

1 says, the EPA standards as they stand now are
2 sufficient, aside from the remanded part, and that
3 further implementation discussion and delineation
4 belongs in the NRC rulemakings and standards and that,
5 of course, is a possible outcome of alternative 3.

6 COMMISSIONER CURTISS: If the EPA standards
7 are sufficient -- and I don't want to go on at length
8 about this. But if the EPA standards are, in fact,
9 sufficient, if there's nothing inherent in the
10 standard that demonstrates that in a hypothetical
11 context it can't be met by a repository somewhere,
12 that as a theoretical matter you can go through the
13 intellectual process of demonstrating compliance. If
14 that's true today, and I take it the staff is saying
15 that it is, then if there are additional details that
16 need to be explained about the implementation of the
17 standard, including details that go beyond what we
18 said in '85, my own view is those ought to be in the
19 NRC regulations because they are matters of
20 implementation and they are not matters of
21 establishing a generally applicable environmental
22 standard.

23 MR. TAYLOR: That's possible outcome.

24 MR. BERNERO: Yes. You're not alone in that
25 view and --

1 CHAIRMAN CARR: I need to ask one question,
2 Is it your position, Jim, that the current NRC
3 standards are inconsistent with the EPA standards?

4 COMMISSIONER CURTISS: I guess my own view
5 is that as I look at 60.113, it doesn't seem to me
6 that that set of standards is a translation or an
7 articulation of how you implement the standard. Take
8 one example, the one that we talked about earlier.
9 There's a case where you could meet the EPA standard,
10 but you can't meet 60.113.

11 Now, I think it's been fairly clear all
12 along as we've looked at the subsystem performance
13 criteria that, as the staff said as early as '81, that
14 if you meet the EPA standards, you don't necessarily
15 meet 60.113 and vice versa. In the division of
16 responsibilities between the two agencies where EPA
17 sets the general standards and we, in turn, set up a
18 framework for how you implement that, I'm puzzled that
19 you can reach a result that could meet the EPA
20 standard as a technical matter, but does not satisfy
21 the set of implementing regulations.

22 CHAIRMAN CARR: The Act requires us to not
23 be inconsistent with EPA standards.

24 MR. BERNERO: Yes, but at the same time--
25 you know, there's a phrase we used to use in reactor

1 regulation that these are orthogonal ways to analyze
2 safety, that in the performance assessment, EPA
3 standard, we have a mechanistic model of all the
4 events and processes and what their outcomes would be
5 and we have a best estimate of what the outcome is.

6 In the NRC standard, we approach it from a
7 totally different way and we have a building block,
8 defense in depth and all these qualitative things and
9 that they both purportedly come out with an acceptable
10 site. They are very different. They are orthogonal
11 in the way they view --

12 COMMISSIONER CURTISS: They're inconsistent
13 in the hypothetical that we talked about.

14 MR. BERNERO: Yes, but the result and the
15 measure of an acceptable disposal site is that by the
16 orthogonal analyses we have found it acceptable both
17 ways.

18 CHAIRMAN CARR: We're required to be not
19 inconsistent.

20 MR. BERNERO: Yes, and not inconsistent, but
21 with sufficient confidence to satisfy our
22 responsibility to say in that unprecedented thing,
23 "There's no undue risk for people who are going to
24 live here tens of thousands of years --"

25 COMMISSIONER CURTISS: Let's make it clear.

1 When the applicant comes in today and the applicant
2 today, assuming the EPA containment criteria is
3 finalized as is, and the applicant is going to have to
4 demonstrate two things, not one. They're going to
5 have to demonstrate that they comply with the EPA
6 standard and they're going to have to demonstrate that
7 they comply with 60.113.

8 Now, I agree with you that that approach
9 gives you a greater degree of confidence in one
10 respect. But at the same time, it has led to the
11 lesser degree of confidence because we're now forced
12 to litigate the uncertainties that derive from 60.113.
13 Simply from a legal perspective, having to demonstrate
14 two things rather than one is going to complicate the
15 licensing proceeding. I'm not opposed to that if you
16 can demonstrate that you meet the EPA standard by
17 demonstrating that you meet 60.113, but that's not
18 where we are.

19 CHAIRMAN CARR: I would recommend we turn
20 back to Commissioner Rogers. We're working on his
21 time.

22 COMMISSIONER ROGERS: These are all still
23 very interesting questions to me, that's why I haven't
24 complained. But I think that this model that you've
25 described, Mr. Bernero, for orthogonality with respect

1 to these two ways of looking at it, I'm not sure--
2 maybe you're right, but I don't necessarily buy that
3 that applies here and I'm not sure whether there isn't
4 some congruence here and that's part of the problem,
5 that they really aren't orthogonal.

6 To me, an orthogonal set, they're
7 independent. They're totally independent. If what
8 we're seeking is, in our axis of orthogonality, of one
9 of the two orthogonal axes, a more qualitative
10 approach, then I can understand that, that what we're
11 seeking is some interpretation allows us to apply
12 qualitative measures in addition to the quantitative
13 measures which come out of the EPA standards. This is
14 the way I'm looking at it. Maybe I'm wrong, but I'm
15 looking at it more from that point of view.

16 If what you're trying to do is get some
17 agreement from EPA that there is an additional way of
18 interpreting these things, that allows the
19 introduction of qualitative judgmental factors, expert
20 opinions or whatever. I don't know how you're going
21 to go about doing that. I'd like to hear a little bit
22 more about how you, in fact, want to do that. But
23 that I see as two independent axes for judgment here
24 in a new space to put these things.

25 But I'm worried that maybe what we have is

1 not exactly that, but we do have the possibility of
2 overlapping requirements that Commissioner Curtiss is
3 talking about.

4 MR. BERNERO: I need to acknowledge -- you
5 are absolutely correct. They are no less orthogonal
6 than reactor safety analysis and PRA are because
7 reactor safety analysis has buried in it things like
8 the no single failure criterion which are veiled
9 reliability or probability measures.

10 But you're right, the defense in depth
11 elements of the package and so on have a certain
12 commonality to a mechanistic analysis or realistic
13 analysis of what could happen.

14 COMMISSIONER ROGERS: Well, I don't know
15 that we have the time today or really are prepared to
16 do it, but I would like to know more about how you
17 intend to deal with these uncertainties in the
18 probablistic area and whether you intend to use an
19 approach such as was used in NUREG 1150 of some kind
20 of collection of expert opinions brought to bear on
21 producing some kind of judgments or just what you
22 intend to do, how you intend to get those distribution
23 functions that are relevant to each one of these
24 probablistic assessments. I hope we could learn a
25 little bit more about that.

1 MR. BERNERO: Yes. That's a very important
2 field and that's --

3 COMMISSIONER ROGERS: But how you're going
4 to do it, I think, is very important.

5 The other thing is, just sort of jumping
6 more toward the end of my list, it sounds to me from
7 what you've just said in terms of staff's
8 recommendation is alternative 3, that that's in
9 disagreement with the recommendation that was in SECY-
10 319, which was an alternative 1 which, I think, if I'm
11 correct there -- am I mistaken that the recommendation
12 out of SECY-319 was essentially alternative 1?

13 MR. BERNERO: If you look at alternative 3
14 on page 12 of the SECY paper, this was the difficulty
15 of how many subalternatives we would put in the paper.
16 We said current or revised EPA standards and we
17 weren't referring to the part that needs fixing from
18 the remand.

19 MR. TAYLOR: That was in recognition that
20 indeed the current standards may be as good as you can
21 do, accepting that the initiative wasn't further
22 qualification appropriate. This grows out of the
23 tension discussion that exists within the staff and, I
24 think, others.

25 Part of the management of this process has

1 been to, from an EDO standpoint, recognizing this and
2 recognizing that there may be time and this might be a
3 good time to look at the EPA standards and the way we
4 proceed further with rulemaking and bring to bear the
5 knowledge that we have gained in the past few years in
6 the reactor side, bringing all those together.

7 This started about a year or so ago when
8 sort of a broader band of the staff got more deeply
9 involved in this. It was all those things together
10 that brought us to say, we need to come to the
11 Commission and lay this issue out. We don't have all
12 the answers at this time, clearly. We may not even be
13 able to make the EPA standard better. If we don't,
14 then we face our own rulemaking process, as you
15 outlined, Commissioner, to try to work this problem
16 through.

17 It is a knotty problem because of the
18 probablistic aspects. That's the general agreement
19 about it being knotty. We face some years down, if
20 not for this repository, but the recommendation for a
21 revised -- or in the process of litigation that will
22 prevail and we're trying to do the best job here early
23 on that we can to get the clarification, to get the
24 thoughts in place, the best we can do in 1989 to work
25 this problem, to solve issues now if we can.

1 CHAIRMAN CARR: Well, you talk on page 17,
2 "The staff anticipates this resolution will consist of
3 modifications to the EPA standards and NRC
4 rulemaking."

5 MR. TAYLOR: Yes.

6 CHAIRMAN CARR: Do you know what
7 modifications you need?

8 MR. BERNERO: For their standard?

9 CHAIRMAN CARR: Yes.

10 MR. BERNERO: That's not clear. But the
11 preponderance of what is needed is described on page
12 13 of the paper where in alternative 3 we spoke of the
13 great scope and depth of the rulemakings that NRC has
14 to do and we've enumerated some of the details, not
15 that we have the answers.

16 CHAIRMAN CARR: Well, you referred that we
17 learned a lot from WIPP. What have we learned
18 specifically? Is WIPP going to be able to be licensed
19 under these standards? Are they going to meet them?

20 MR. BERNERO: Unfortunately, the WIPP
21 schedule has slipped and everyone's been watching
22 vigilantly because the same standard would be applied
23 and we believe the mechanism is in place whereby the
24 Department of Energy would publish the performance
25 assessments and analyses that go toward implementation

1 of the EPA standard in a supplement to their
2 environmental statement.

3 CHAIRMAN CARR: So nobody has any
4 indication that there's a hangup on WIPP.

5 MR. BERNERO: But the best information we
6 have now is that it's been put off until '92 or '93.

7 MR. BROWNING: 1992.

8 CHAIRMAN CARR: But we haven't pinpointed
9 some problem with those standards from WIPP?

10 MR. BERNERO: No.

11 CHAIRMAN CARR: Okay.

12 COMMISSIONER ROGERS: So we don't know
13 exactly how we're going to revise Part 60? Is that
14 what you're saying?

15 MR. BERNERO: Not yet.

16 COMMISSIONER ROGERS: Okay.

17 MR. BERNERO: But the key rulemaking --

18 COMMISSIONER ROGERS: But it's opening the
19 possibility up, but you haven't --

20 MR. BERNERO: Just by way of example, the
21 key rulemaking in some respects is going to be how do
22 you classify events? Do you have situational criteria
23 which say, "These are the criteria by which you judge
24 whether an event is in the bin likely or unlikely but
25 worthy of consideration or so unlikely as to be

1 negligible," that you would use situational criteria
2 and that you wouldn't run out to a seismologist and
3 say, "Give me the probability of an earthquake of this
4 magnitude," that you would use the probabilities as a
5 description. But you need a structure for that.
6 That's very difficult to do.

7 CHAIRMAN CARR: Does -- the EPA may not want
8 to address any changes to those standards since the
9 court seemed to buy those. Does that have any effect
10 on what we want to do, the fact that the standards
11 weren't found effective in the court decision?

12 MR. BERNERO: Are you referring to any
13 discussion of the groundwater and individual
14 protection part or the probablistic part?

15 CHAIRMAN CARR: I'm just saying that the
16 standards, per se, weren't -- the probablistic part
17 wasn't found effective.

18 MR. BERNERO: It was not remanded. In other
19 words, it just didn't come into the remand. But
20 nonetheless, EPA, in working draft number one for the
21 repromulgation of the standard, following their
22 previous practice, has shared working draft number one
23 with us and with others to solicit constructive
24 comment. We do have a healthy dialogue with them on
25 that. We expect to see their working draft number two

1 very shortly.

2 COMMISSIONER ROGERS: I'm finished.

3 CHAIRMAN CARR: Commissioner Curtiss?

4 COMMISSIONER CURTISS: Are they proposing in
5 that draft to reopen the containment provision?

6 MR. BERNERO: Some -- yes. In working draft
7 number one, there were some things and we're
8 discussing that very point.

9 COMMISSIONER CURTISS: Even though the court
10 did not remand on those issues?

11 MR. BERNERO: Right. And the staff,
12 probably a year or two ago, I know I've said it at
13 this table, that we were prepared to leave well enough
14 alone and sort of freeze those parts of the standard
15 as is and live with it. And there's still a
16 substantial view in staff that we may end up that way
17 in alternative 3, that those qualifications or
18 implementation details that are already there may be
19 sufficient.

20 COMMISSIONER CURTISS: Well, regardless of
21 whether they reopen the containment provision and
22 recognizing that that was not remanded by the court, I
23 guess I'd be inclined to say that at this point,
24 particularly if they do, and given the hiatus in the
25 program that we have now, I think as Commissioner

1 Rogers has alluded to, it would be an opportunity to
2 go back and look at a number of things. He's
3 mentioned the underlying premise he's for the approach
4 that we've taken.

5 I guess the matters that are of greatest
6 interest to me are discussed in some detail already.
7 I continue to be puzzled about the connection between
8 the subsystem components criteria and the EPA
9 standard. I do not think that -- well, put it
10 differently. If the subsystem performance criteria
11 are, in fact, the means of articulating how you meet
12 the EPA standard, then it seems to me that that's
13 consistent with the Agency charge under the statute.

14 If they're not, if they're in fact a
15 separate set of criteria and that they can provide an
16 additional different degree of confidence in the
17 decision that we're reaching, it doesn't appear to me
18 though, A, that they are essential to ensure that the
19 defense in depth approach. I think we've past that
20 point. And B, that additional degree of confidence,
21 proving different things in a different way, has some
22 costs associated with it, the uncertainty/^{of}rulemaking,
23 the complications in the litigation, and the ability
24 to meet the three year licensing period.

25 In addition, they have, as we talked about a

1 hypothetical, they have an impact upon how DOE might
2 strike the balance in achieving the defense in depth
3 between the container and the geologic medium.

4 So, for those reasons, I'll be encouraging
5 you to go back and take a look at 60.113 and, given
6 where we are today, to reexamine the continuing need
7 for that set of the regulations. I guess that's an
8 issue that we ought to take a look at.

9 I also think it's appropriate at this point,
10 particularly if we're going to reopen the containment
11 standard, to take a look again at this underlying risk
12 basis for the EPA standard. For the first time, I
13 think the staff is saying in this paper, for the first
14 time that I'm aware of, that the EPA standard is, in
15 fact, comparable to the other kinds of risks that we
16 regulate, particularly in the reactor community. I've
17 always understood, or it's been my impression, that
18 the EPA standard was something that we agreed to not
19 because of its approach to risk, but because it was
20 simply achievable, DOE's facility could meet that
21 standard. That's an issue too that at some point we
22 might want to take a look at.

23 CHAIRMAN CARR: Anything else?

24 Thank you, gentlemen.

25 We'll get Doctor Kuts up.

1 Welcome, Doctor Kouts. You may proceed.

2 DOCTOR KOUTS: Thank you very much, Mr.
3 Chairman.

4 Let me begin by correcting one thing which
5 you said when you mentioned my presence earlier. The
6 Defense Nuclear Facility Safety Board is not part of
7 the Department of Energy. It's an independent agency.

8 CHAIRMAN CARR: All right. I stand corrected.

9 DOCTOR KOUTS: With oversight over the
10 Department of Energy.

11 CHAIRMAN CARR: Thank you.

12 DOCTOR KOUTS: As you may well be aware, I'm
13 here today not representing the Defense Nuclear
14 Facility Safety Board. I'm here to state some
15 opinions of my own which I've developed over a number
16 of years. In fact, the Defense Nuclear Facility
17 Safety Board cannot really have anything to say about
18 any matter which is under the purview of the Nuclear
19 Regulatory Commission and it's prohibited by law from
20 doing so.

21 I would like to make a logical case for what
22 I have to say by covering some ground which I'm sure
23 you are well aware of and you'll forgive me if I say
24 some things that you well understand.

25 In talking about PRA first of all as it's

1 applied to nuclear power plants, because this is the
2 derivative of -- that is the application to a waste
3 facility would be a derivative of the application to
4 the nuclear power plants.

5 As you well know, the input data which go
6 into the analysis for nuclear power plants have large
7 uncertainties attached to them and are represented by
8 large, wide distribution functions on the
9 probabilities that enter into the calculations. These
10 are the results of many things, human factors,
11 difficulty in predicting rare events, the difficulty
12 in applying engineering calculations to very
13 difficult -- to very unusual engineering situations
14 and extreme physical conditions.

15 The result is relatively large uncertainty
16 bands in the results. The distribution functions on
17 risk have very wide bands attached to them as well.
18 For this reason, the Commission has wisely refrained
19 from placing bottom line reliance on PRA results in
20 its determination of safety in the nuclear reactor
21 field.

22 It's realized, however, that PRA offers the
23 only quantitative answer to the question of how safe a
24 certain situation or a certain thing may be. So, PRA
25 is naturally brought into the process of a

1 determination whenever this question comes up, as it
2 often does, but the uncertainty bounds have to be kept
3 in mind.

4 The Commission has said that it will simply
5 not judge the safety in the specific reactor case on
6 the basis of bottom line PRA numbers. This is the
7 wise conclusion. Sometimes it's said that the bottom
8 line results will not be used in specific cases.

9 Now, in its implementation of safety goals,
10 the Commission has said that the results of PRA will
11 be used as one item in a final determination of
12 whether safety goals are met. This would recognize
13 the uncertainty bounds. But also included in such a
14 determination would be such things as deterministic
15 safety analysis, the safety culture which might be
16 determined to exist in a certain situation, SALP
17 results and other input data of that kind. So, this
18 has been the basis for determination of safety in
19 those cases.

20 Now, let me turn to the question of waste.
21 Here, the PRA problem is substantially different. You
22 don't have mechanisms whose success or failure of
23 operation is going to be the basis of a determination
24 of the outcome of a PRA. Instead, you have conditions
25 that you expect to exist at a waste facility. That is

1 the way the operation will take place, the way the
2 facility will be constructed, and you have to take
3 into account, of course, as a very large factor, the
4 natural events that might occur and might influence
5 the effectiveness of the repository in the future.
6 These events are, as has been said earlier this
7 morning, such things as volcanism, floods,
8 hydrological changes, changes in climate, and many
9 things which occur over a great many years.

10 Now, EPA has recognized the difficulty in
11 prediction of these things. Following discussions
12 with the NRC staff in which this was a large item of
13 discussion, the EPA has agreed to the concept of
14 reasonable expectation or reasonable assurance as a
15 basis for entering probabilities of this kind into the
16 calculations that PRA may have for a waste repository.

17 Even here, however, there will be
18 disagreements on the implications of what is found as
19 they are entered into the calculations. Disagreement
20 on what the physical record shows. This has already
21 occurred at such proposed facilities as the one at
22 Hanford earlier, which the Department of Energy has
23 put aside, and at Yucca Mountain, where there are
24 disagreements on implications of past volcanism and
25 post hydrological conditions.

1 The PRA results are going to reflect
2 uncertainties of this kind. I am quite sure that
3 when -- and this will occur in the future -- when the
4 NRC staff has carried through its probablistic risk
5 assessment applicable to a particular repository which
6 it is considering in the licensing context, and has
7 arrived at a reasonably judged PRA as a result of
8 this, this PRA will be contested on all sides because
9 the input data are not as precise and not as readily
10 determined as they would like to have it.

11 The litigation in this respect is going to
12 be substantially greater than the litigation that has
13 occurred with respect to PRA in the past and the
14 questioning of PRA in its applications here is going
15 to be substantially greater. I don't see how the
16 Commission can adopt a course which supports the
17 application of PRA to a stronger extent for waste
18 repositories than it has taken for the nuclear reactor
19 field.

20 This comes to the core of my argument at
21 this point. I think PRA has its legitimate place in
22 the determination of safety of a repository and the
23 adequacy of the repository. But I think that PRA in
24 this particular case will have to be considered again
25 as one element in a matrix of matters which the

1 Commission will have to consider as a basis for the
2 safety of repositories in the future and that this is
3 the appropriate time to raise this with EPA as the
4 basis for joint regulations to be issued by the
5 Commission and EPA in the future to cover
6 acceptability of repositories.

7 I come out then not disagreeing with the
8 basic objective of what the staff has come forward and
9 proposed to you today. That is to go back and
10 consider further with EPA the changes which now have
11 to be introduced. But I feel that this particular
12 aspect of it has to be introduced at this time so it
13 is clear from the beginning that the Commission is not
14 relying on PRA alone in this final judgment.

15 That is my point.

16 CHAIRMAN CARR: Thank you, sir.

17 Any questions? Commissioner Rogers.

18 COMMISSIONER ROGERS: What's your view on
19 the orthogonality model that was brought up here a
20 little bit earlier of these qualitative or other
21 considerations? You've mentioned that we look at a
22 number of factors when we evaluate the safety of
23 nuclear power plants, PRA being just one, other
24 quantitative measures of various kinds and other
25 qualitative measures.

1 Do you have any particular thoughts on how
2 this way of looking at a system and putting it into
3 some kind of a hyper space of orthogonal axes that
4 have different labels on them, whether that makes any
5 sense as a way of conceptualizing a decision?

6 DOCTOR KOUTS: No, Commissioner Rogers. I
7 think I'm as troubled by such a set of terms as you
8 are. I don't see the term "orthogonality" being
9 applicable here. Supplementary, yes or complimentary,
10 yes, but not orthogonality. Orthogonality, as it's
11 borrowed from physics, means that they have no
12 relationship whatsoever with each other.

13 COMMISSIONER ROGERS: Independent, truly
14 independent.

15 DOCTOR KOUTS: Yes. Now, they are not truly
16 independent. They do have overlap. For instance, the
17 event trees in probablistic risk assessment are based
18 on deterministic understanding of the safety
19 situation. They are, however, complementary ways of
20 deriving information from the deterministic views that
21 we have.

22 COMMISSIONER ROGERS: Well, just -- it seems
23 to me that there is some utility in thinking about
24 things in this way, but one has to be careful.

25 DOCTOR KOUTS: One has to be careful.

1 COMMISSIONER ROGERS: They're not
2 independent.

3 DOCTOR KOUTS: The image is not quite right.

4 COMMISSIONER ROGERS: Right.

5 CHAIRMAN CARR: Any other questions?

6 Commissioner Curtiss?

7 COMMISSIONER CURTISS: No questions. Thank
8 you.

9 CHAIRMAN CARR: Thanks very much, Doctor
10 Kouts.

11 DOCTOR KOUTS: You're welcome.

12 CHAIRMAN CARR: Any questions?

13 Well, the staff is to be commended for its
14 rigorous reevaluation of its views on implementation
15 of probablistic standards in the licensing of a high-
16 level waste repository. The complex geologic
17 processes involved and the need to project the long-
18 term performance of the natural and manmade components
19 of a repository make this a challenge unprecedented in
20 engineering and risk assessment practice.

21 I'd like to give our special thanks to
22 Doctor Kouts for taking the time from his other
23 responsibilities to share with the Commission his
24 views based on his years of experience and the
25 application of probablistic techniques.

1 I understand that the ACNW will meet in the
2 near future to discuss these issues and will provide
3 comments to the Commission. After receipt of these
4 comments, I urge my fellow Commissioners to carefully
5 consider the information before us in formulating a
6 vote on the staff's recommendation.

7 I'm sure -- Mr. Egan, we're happy you're
8 with us today and I'm sure you've got complete ideas
9 now on how to rewrite this thing. If it's as clear in
10 your mind as it is in mine, you should have no trouble
11 at all.

12 Unless there's some additional questions or
13 comments, we stand adjourned.

14 (Whereupon, at 10:50 a.m., the above-
15 entitled matter was adjourned.)
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CERTIFICATE OF TRANSCRIBER

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

TITLE OF MEETING: BRIEFING ON IMPLEMENTATION OF THE U.S. ENVIRONMENTAL
PROTECTION AGENCY'S HIGH-LEVEL WASTE DISPOSAL STANDARDS
PLACE OF MEETING: ROCKVILLE, MARYLAND

DATE OF MEETING: NOVEMBER 21, 1989

were transcribed by me. I further certify that said transcription
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**IMPLEMENTATION OF THE EPA
HIGH-LEVEL WASTE STANDARDS**

November 21, 1989

Robert M. Bernero

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OUTLINE

- Underlying basis of the HLW standards.**
- Regulatory requirements and the role of performance assessment.**
- Questioned and favorable features of the standards.**
- Sample application of the standards.**
- Recommendation.**

UNDERLYING BASIS

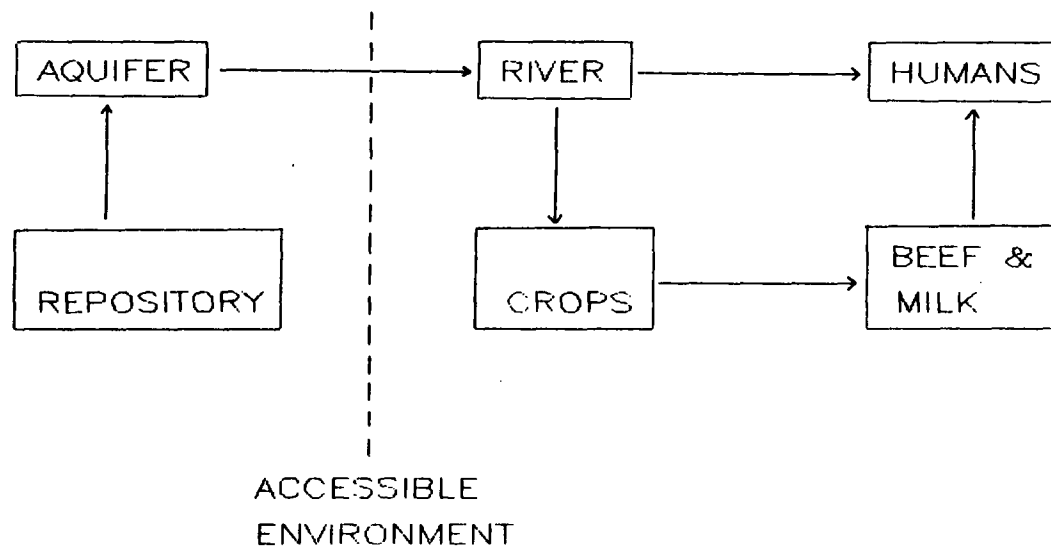
Future generations:

- will eat as we do
- will drink as we do
- will suffer radiation as we do

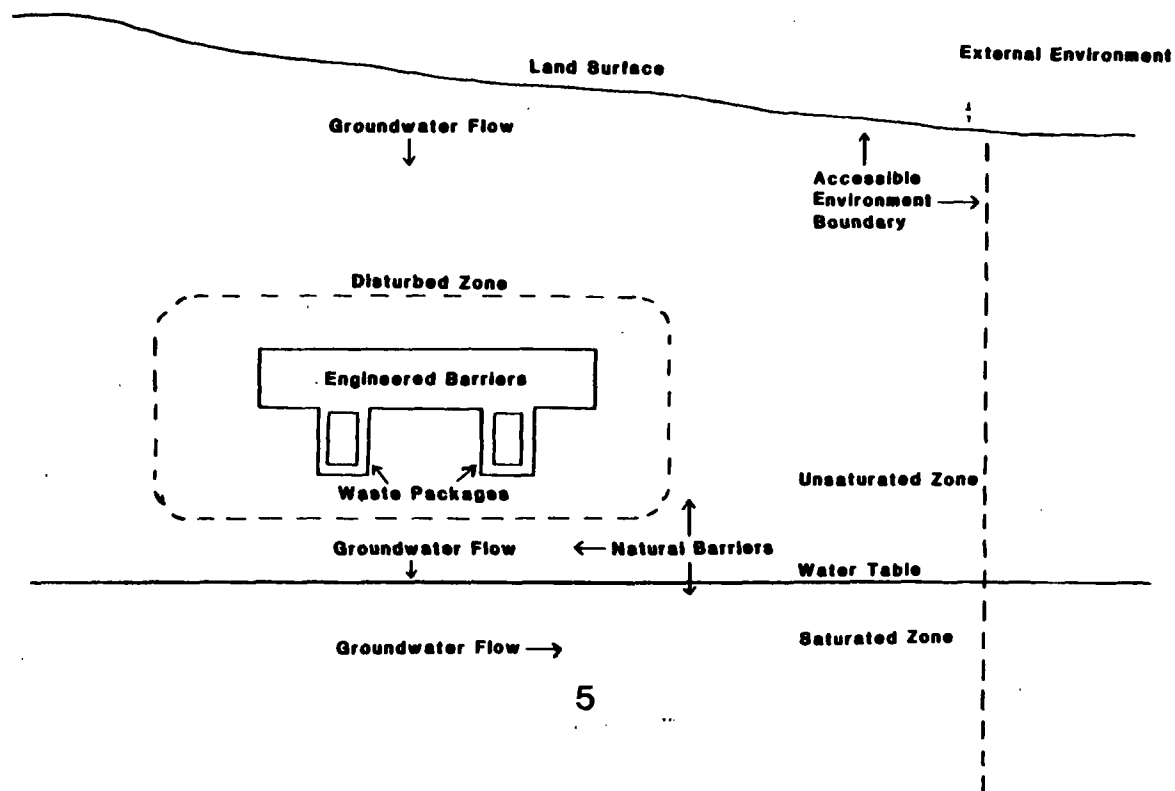
The basis:

Disposal of wastes in a passive repository
will ensure that they will not suffer
undue risk from our activities.

EVALUATION OF IMPACTS IN HUMAN ENVIRONMENT



SCHEMATIC OF REPOSITORY



REGULATORY REQUIREMENTS

EPA standards for the overall system

Containment Requirement

- Limits total activity released
over 10,000 years**
- Stated probabilistically**

Individual Protection Requirement

Groundwater Protection Requirement

REGULATORY REQUIREMENTS (Cont'd)

NRC requirements for subsystems

Performance objectives

- Waste package containment**
- Engineered barrier release rate**
- Groundwater travel time**

Siting criteria

Design criteria

CONCERNS ABOUT THE STANDARDS

- Standards are unduly restrictive.
- Standards limit releases, not doses.
- Use of probabilities can paralyze the regulatory process.
- Processes are difficult to quantify.
 - Conflicting subjective probabilities.
 - Implied rigor of calculation.

CONCERNS ABOUT THE STANDARDS (Cont'd)

- Mismatches between NRC and EPA criteria.
- Scenario classes and terminology.
- Treatment of human intrusion.

FAVORABLE FEATURES OF STDS

- Emphasis on releases rather than doses simplifies the standards.**
- Time cut-off limiting speculation about very long-term phenomena.**
- Qualitative considerations language.**
- Guidance in Appendix B of the standards — especially on potential human intrusion.**

**FAVORABLE FEATURES OF STDS
(Cont'd)**

—Both EPA and NRC regulations are open
for revision.

NEED FOR PERFORMANCE ASSESSMENT

—NRC must protect public health.

HOWEVER, to do so there will be:

—No base of operating experience.

—Little opportunity for monitoring.

—Limited use of defense-in-depth designs.

THEREFORE, performance assessment is used:
a quantitative projection of repository
performance, including uncertainties.

PERFORMANCE ASSESSMENT is:

- Mathematically modeling physical processes.
- Roughly analogous to containment performance assessment for reactors.

BUT:

- Times and distances are much greater.
- Data base is limited.
- Regulatory role is different.

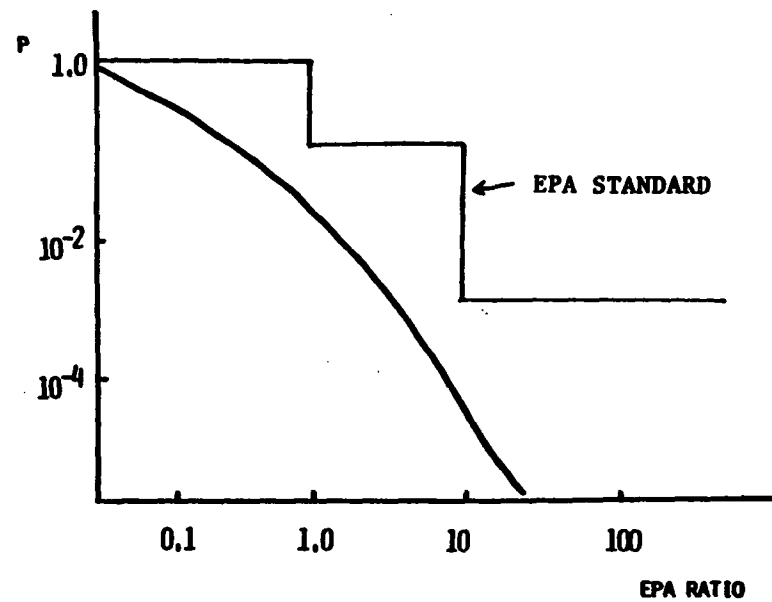
EPA REQUIREMENT

Radionuclide	Release limits (Curies)
C-14 or I-129	100
Tc-99	10,000
Th-230 or 232	10
Any other alpha-emitter	100
Any other beta-emitter	1,000

Probabilistic nature:

- Likely (1.0-0.1) release less than above.
- Unlikely, but considerable (0.1-0.001)
release less than 10X the table values.

GRAPHICAL REPRESENTATION



ISSUES FOR LICENSE REVIEW

1. What can go wrong?
2. What are the consequences?
3. How likely is it to happen?

All are technically complex and
require projections of future conditions.

#3 is the issue at hand —
Should it be addressed numerically
or in a qualitative manner?

**EXAMPLE:
HYPOTHETICAL REPOSITORY**

<u>Scenario</u>	<u>Estimated probability over 10,000 yr.</u>	<u>Calculated consequence (EPA ratio)</u>
Baseline	0.989-0.9899	0.1
Fault movement	0.01*	1.0
Volcanic event	0.001-0.0001	100

*Conservative, upper-bound estimate

VOLCANISM EXAMPLE

- Model A

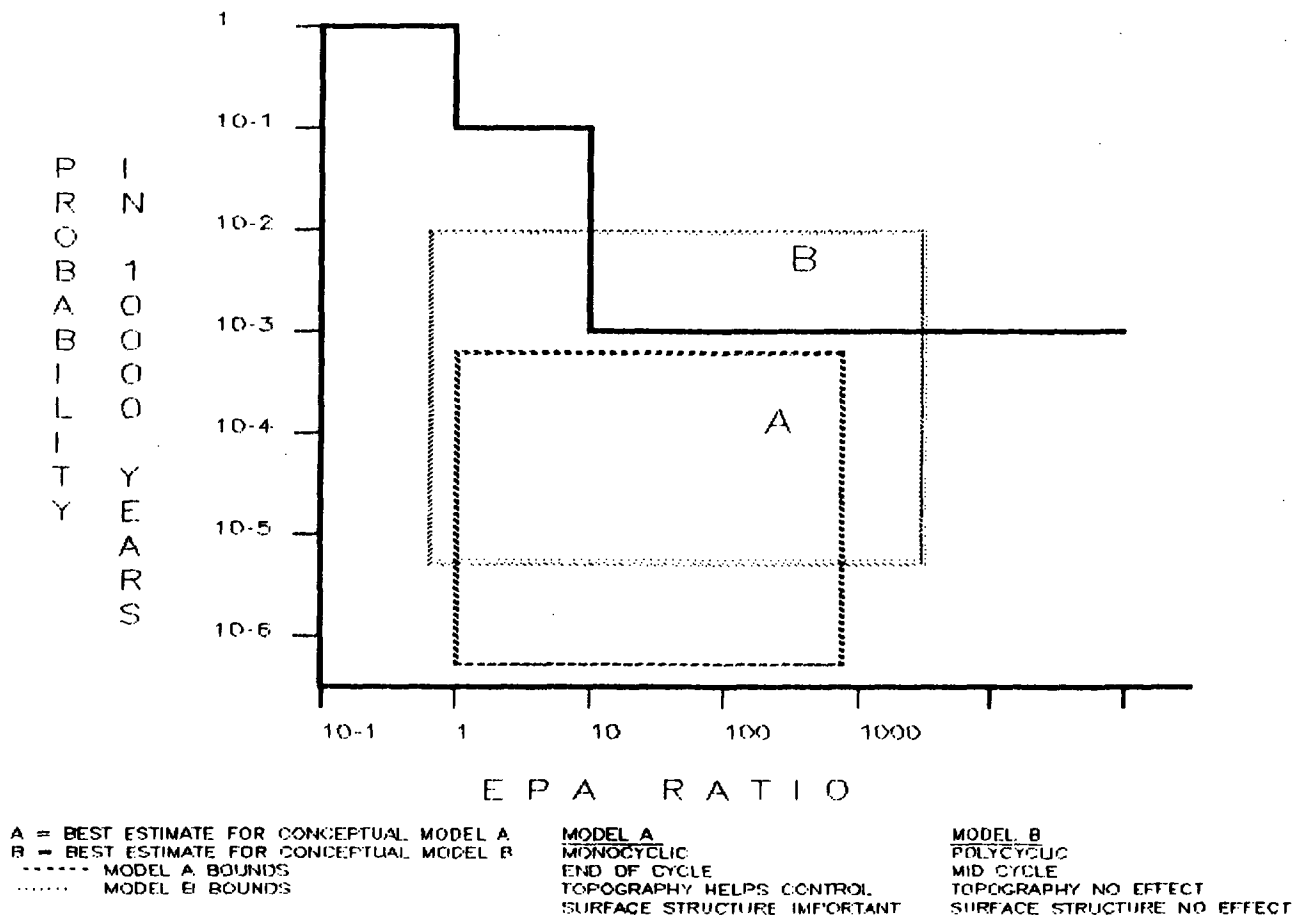
- Cones result from single eruptions.
- The rate of recent activity is waning.

- Model B

- Cones result from multiple eruptions.
- Recent activity is the middle of a cycle.

- Scientific information allows selection of the more reasonable probability estimate.

ALTERNATE CONCEPTUAL MODELS ON VOLCANISM PLOTTED IN CCDF SPACE



ALTERNATIVES

1. Current EPA standards and Part 60.
2. Revised EPA standards and current Part 60.
3. Current or revised EPA standards and revised Part 60.
4. No EPA standards and current or revised Part 60.

CONCLUSION AND RECOMMENDATION

- Evaluation of repository safety is inherently difficult because of long times and large uncertainties.**
- The EPA standards illuminate those difficulties, but do not cause them.**
- Alternative approaches do not appear to be preferable.**

CONCLUSION AND RECOMMENDATION (Cont'd)

-The recommendation of SECY-89-319
offers a way to achieve implementability
of the standards.



POLICY ISSUE

October 17, 1989

(Notation Vote)

SECY-89-319

For: The Commissioners
From: James M. Taylor
Acting Executive Director
for Operations

Subject: IMPLEMENTATION OF THE U. S. ENVIRONMENTAL PROTECTION
AGENCY'S HIGH-LEVEL WASTE DISPOSAL STANDARDS

Purpose: In response to Staff Requirements Memoranda M890711A of July 21 and M890726B of August 8, 1989, this paper informs the Commission of: (1) the status of the U. S. Environmental Protection Agency's (EPA's) high-level waste (HLW) disposal standards development; (2) the U. S. Nuclear Regulatory Commission (NRC) staff's reevaluation of its views on implementation of probabilistic standards; and (3) the status of the staff's reevaluation of the use of such quantitative standards by development of procedures and rules that are needed for implementing the standards.

- To request Commission approval of staff plans to pursue a continuing evaluation of the EPA standards by way of rulemakings and interactions with EPA's staff.

Summary: EPA, pursuant to the provisions of the Nuclear Waste Policy Act of 1982 (Pub. L. 97-425), is responsible for development of environmental radiation protection standards for disposal of HLW. NRC is responsible for licensing the disposal repository, but its licensing judgment must be based on compliance with the EPA standards. EPA promulgated its standards in 1985, but the standards were vacated in 1987 by the U. S. Court of Appeals. They are expected to be reissued for public comment in late 1989, and some parts of the standards are expected to remain unchanged from those promulgated earlier. Specifically, the probabilistic nature of the "containment requirements" section, which was initially opposed by the Commission, is expected to be retained. The staff's reevaluation of its views on implementation of probabilistic standards in a HLW repository licensing review and the basis for the staff's

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views are presented in this paper. This paper also discusses U.S. Department of Energy's (DOE's) plans for demonstrating compliance with the standards and the NRC staff's plans for rulemakings related to implementation of the standards.

Before EPA issues revised standards for public comment, the staff will provide the Commission an evaluation of the technical basis from which the revised standards were derived, and any comments the staff considers should be provided to EPA before publication of those standards.

Background:

HLW (including spent nuclear fuel) is highly radiotoxic and will remain hazardous for thousands of years. Projecting the performance of the natural and man-made components of a repository over such a long time will involve uncertainties that may be unprecedented in engineering and risk assessment practice. The challenge facing NRC and EPA is to develop a regulatory approach that will accommodate these uncertainties. Such a regulatory approach should allow licensing decisions to be reached on acceptance of suitable sites and designs and rejection of unsuitable ones, while avoiding reliance on overly conservative approaches that would excessively increase disposal costs or might eliminate suitable repositories from consideration.

In the late 1970's, EPA began development of environmental radiation protection standards for disposal of HLW. As the benchmark for overall repository system safety, those standards address: (1) the time period after disposal for which repository performance must be projected (at least 10,000 years); (2) the conditions for which performance is to be assessed (both expected performance and performance following reasonably foreseeable disruptive processes and events); and (3) the maximum allowable contamination of groundwaters, doses to individuals, and population impacts. The standards reflect an unprecedented societal concern over the perceived long-term hazards of HLW, and an apparent societal willingness to bear the cost of implementing the safest disposal technology that is reasonably achievable.

On December 29, 1982, EPA published its proposed standards (40 CFR Part 191, 47 FR 58196) and solicited public comment on them. Of particular note was the probabilistic nature of the standards, which endorsed a non-linear, inverse relationship between the allowable size of a release and the likelihood that a release would occur. NRC's comments

(dated May 10 and 11, 1983) objected to the probabilistic nature of the standards, stating, in part, that "[t]he numerical probabilities in [the standards] would require a degree of precision which is unlikely to be achievable in evaluating a real waste disposal system." The NRC comment went on to explain that "...identification of the relevant processes and events affecting a particular site will require considerable judgment and will not be amenable to accurate quantification, by statistical analysis, of their probability of occurrence."

EPA retained its numerical standard, but in response to NRC's comments, EPA added wording to the final standards which was virtually identical to the wording of Section 101 of 10 CFR Part 60. This text recognized the long time involved and the associated substantial uncertainties in projecting HLW repository performance, and emphasized that a "reasonable expectation," rather than absolute proof, is to be the test of compliance with the standard.

In an additional attempt to provide flexibility for implementation of the standards, EPA also provided that "quantitative predictions of releases from a repository were to be incorporated into an overall probability distribution only "to the extent practicable." This phrase appears to allow at least some additional discretion for NRC to incorporate qualitative considerations into its decision-making, rather than placing sole reliance on numerical projections of repository performance.

Based on these changes in EPA's standards, the NRC staff withdrew its objection to the standards. In SECY-85-272, dated October, 1985, the staff informed the Commission that "[a]lthough the staff continues to believe that the probabilistic nature of the standards will pose a significant challenge, the staff considers that the standards, in the current form, can be implemented in a licensing review." The Commission did not disagree with the staff's assessment and, on September 19, 1985, EPA promulgated final environmental radiation protection standards for disposal of HLW (50 FR 38066). The final standards (40 CFR Part 191) included provisions for (1) groundwater protection; (2) individual protection; and (3) total release of radioactive material to the environment for 10,000 years after waste disposal. The latter requirement, the "containment requirements," retained its probabilistic format, imposing more restrictive release limits for relatively likely releases than for those less likely to occur. Included in the containment requirements was the

qualifying wording referred to previously, recognizing the need for non-quantitative considerations when evaluating compliance with the probabilistic standards. The requirements for groundwater and individual protection were much less encompassing, being limited to "undisturbed performance" for only the first 1,000 years after waste disposal.

A 1987 Federal court decision remanded these standards for further consideration by EPA. The basis for the remand involved the procedures used to issue the groundwater and individual protection requirements and inconsistencies between those requirements and other EPA standards. The probabilistic containment requirements were not found to be defective. A recent internal EPA (working) draft of the revised EPA standards indicates that most, but not all, changes under consideration are related to the court decision, and that the probabilistic portion of the standards is likely to be retained largely unchanged.¹

EPA's pending revision and reissuance of its HLW standards has provided an opportunity for the NRC staff to reexamine its earlier views on implementation of those standards. In particular, the additional experience acquired by the staff since 1985 in probabilistic risk assessments for power plants and application of NRC's safety goals will be drawn on to determine whether the staff still retains its confidence that probabilistic standards can be implemented in an NRC licensing review.

Discussion:

EPA developed its standards by evaluating the performance of several hypothetical repositories and by considering the costs and benefits associated with alternatives such as improved engineered barriers. In describing the standards, EPA stated that "... the Agency [EPA] has been able to develop standards for the management and disposal of these wastes that are both reasonably achievable - with little, if any, effort beyond that already planned for commercial wastes - and that limit risks to levels that the Agency believes are clearly acceptably small" (50FR38070, September 19, 1985). EPA's standards are thus more a generic quantification of "as low as reasonably achievable" (ALARA) than a safety limit based solely on consideration of acceptable levels of risk.

¹ A second working draft is expected later this fall. The staff plans to provide specific written comments to EPA on the second working draft. The staff will inform the Commission of any problems and the staff's recommendations for resolving them prior to providing the comments to EPA.

The probabilistic portion of the EPA HLW standards was derived so that population impacts would be restricted to 1000 premature cancer deaths over 10,000 years for a repository inventory of 100,000 metric tonnes of spent fuel (the approximate inventory to be generated by all currently operating power plants in the U.S.). This average population risk ($10^{-1}/\text{yr}$) is intermediate between the population risk typically posed by a single commercial nuclear power plant ($10^{-2}/\text{yr}$) and that represented by all commercial nuclear power plants in the U.S. ($10^0/\text{yr}$). Thus, although the standards represent something of a generic quantification of ALARA, the level of impacts allowed by the standards does not appear to be significantly different from that currently presented by operating nuclear power plants.

However, it is important to recognize that the achievability of this risk level by a real repository has not yet been tested by analysis and thus achievability by a real repository is uncertain. DOE's current efforts in developing performance assessment capabilities for the civilian repository program may provide significant insights, as will DOE's experience in developing performance assessments for the proposed repository for defense transuranic wastes, i.e., the Waste Isolation Pilot Plant (WIPP). The EPA has proposed that the DOE publish the performance assessments for WIPP in a supplement to the Environmental Impact Statement for that facility, where all can see and comment on it.

An effort by a team of staff from the Offices of Nuclear Material Safety and Safeguards and Nuclear Regulatory Research to conduct preliminary analyses of repository performance will be a further step in answering this question. Meanwhile, the staff intends to give substantial attention to the proposed revisions of the EPA HLW standards. Prior to publication of EPA's revised standards, the staff will provide the Commission an evaluation of the technical basis from which those standards were derived, and any comments the staff considers should be provided to EPA before public comments are requested.

The Nature of the Problem

Differing views on implementation of the EPA HLW standards ultimately derive from different perceptions of the statistical rigor required for estimates of the probabilities of potentially disruptive events such as fault movement, volcanic activity and climate change.

A rigorous application of EPA's numerical standards would require estimates of the probabilities of potentially disruptive events that are derived from a statistical data base of previous occurrences of those events at the repository site. Some of the events of interest may be relatively rare compared to the length of the geologic record for a repository site. A recent National Research Council report² dealing with probabilistic seismic hazard analysis noted that the relatively short historical record of seismic activity requires reliance on other techniques when projecting seismic activity for thousands of years into the future. Moreover, some potential events may not even be evidenced in the geologic record (e.g., human-initiated events). Therefore, a rigorous application of the EPA standards would lead to the conclusion that the standards cannot be implemented in a licensing review. Indeed, this interpretation was exactly NRC's view of the standards when EPA proposed them for public comment in 1982.

EPA retained the numerical standard, but in response to NRC's concerns, EPA added text (previously mentioned), to its probabilistic containment requirements, recognizing the uncertainties involved in projecting repository performance over long time periods. Specifically, EPA stated that "[p]roof of the future performance of a disposal system is not to be had in the ordinary sense of the word in situations that deal with much shorter time frames. Instead, what is required is a reasonable expectation, on the basis of the record before the implementing agency, that compliance . . . will be achieved." In Appendix B of the standards, EPA elaborated on its views on implementation of the standards. There, EPA stated:

Determining compliance with [the standards] will also involve predicting the likelihood of events and processes that may disturb the disposal system. In making these various predictions, it will be appropriate for the implementing agencies to make use of rather complex computational models, analytical theories, and prevalent expert judgment relevant to the numerical predictions. Substantial uncertainties are likely to be encountered in making these

² Panel on Seismic Hazard Analysis, Probabilistic Seismic Hazard Analysis, National Academy Press, Washington, D.C., 1988.

predictions. In fact, sole reliance on these numerical predictions to determine compliance may not be appropriate; the implementing agencies may choose to supplement such predictions with qualitative judgments as well.

This text indicates that EPA did not intend to require that HLW repository licensing decisions be based solely on numerical probability estimates. Rather, EPA recognized that other, more qualitative considerations, such as the multiple-barrier, defense-in-depth concept imbedded in Part 60, would play a major role in evaluating the safety of a proposed repository. Although these statements by EPA characterize the use of non-quantitative factors as "supplemental to" the numerical standard and discuss flexibility in terms of treating uncertainties, the determination that must be made under EPA regulation is that there is a "reasonable expectation" that repository performance will comply with the numerical standard. Thus, while the language added by EPA to the rule and in the Supplementary Information tends to recognize qualitative considerations, an acceptable approach to implementation is still ambiguous and the governing standard is still the probabilistic numerical standard.

NRC Licensing Requirements

Part 60 currently contains language in Section 60.101 recognizing that "reasonable assurance" must have a somewhat different interpretation in repository licensing than it has in other NRC licensing decisions dealing with much shorter time periods. However, Part 60 does not now directly address implementation of the EPA standards, because those standards had not yet been developed when Part 60 was published. After promulgation of the EPA standards in 1985, the NRC published proposed "conforming amendments" to incorporate those standards into NRC's regulations (51 FR 22288, June 19, 1986). Those proposed amendments, which were withdrawn when the Court of Appeals remanded the EPA standard, would have added, to Part 60, text nearly identical to that cited from EPA's Appendix B, previously mentioned. In addition, a lengthy exposition on implementation of the EPA standards was presented in the Supplementary Information for the proposed amendments. The conforming amendments were intended to establish, through rulemaking, the regulatory basis to ensure that the EPA standards could be implemented in a workable manner in NRC's licensing process. As will be discussed later in this paper, the staff anticipates reinitiation of the

conforming amendments rulemaking (and initiation of one or more additional implementation rulemakings) when the EPA standards are reissued. The staff believes that the conduct of these rulemakings can and will ensure that the application of probabilistic analyses in NRC's licensing process will remain carefully judgmental, as intended by EPA and NRC.

Probability Estimates

As discussed previously, numerical probability estimates are not intended to be the sole basis for repository licensing decisions. However, neither are purely qualitative considerations. In the NRC staff's view, the EPA standards require a combination of the two types of information to be weighed when evaluating repository safety. Thus, the question still remains as to whether probability estimates for very unlikely events can be derived in any meaningful way.

The staff view is that probability estimates can be developed that are reasonably defensible -- at least for sites that are not unusually complex or geologically active. (Current information is not adequate to determine whether the Yucca Mountain, Nevada site is so geologically complex and active as to preclude meaningful probability estimates. This is a major issue to be resolved as soon as practicable during site characterization.) The basis for this view consists, in part, of an important distinction between the probability of occurrence of a potentially disruptive event and the probability that a release of radioactive material to the accessible environment will occur within the 10,000-year regulatory period addressed by the EPA standards. The very low probability contained in the standards -- one chance in 1,000, over 10,000 years -- refers to a release to the accessible environment rather than the occurrence of an event that might lead to the release. The probabilities of events and releases can be quite different because of three factors, referred to here as the resiliency, geometric, and time factors.

Resiliency factor. The nature of an HLW repository is such that it may be partially or totally resistant to some types of events. As an example, vibratory ground motion associated with fault movement is likely to be relatively unimportant because for most repository designs there are no components whose integrity is sensitive to vibratory ground motion. Similarly, drilling into a repository during the first 300 to 1000 years, when waste canisters

are required to be substantially intact, or drilling into an unsaturated zone repository, may cause little or no release unless the drilling directly strikes a canister. If a repository site were found with a groundwater travel time between the repository and the accessible environment approaching 10,000 years, that site would be resistant to most events other than those that could substantially shorten the groundwater travel time. The staff anticipates that, for some events, there will be no need for probability estimates, when it can be shown that the repository system is resistant to the disruptive effects of the events.

Geometric factor. Generally, the NRC and EPA regulations presume that a repository would be located within a larger, relatively homogeneous geologic setting. The geologic record of this larger area can provide the basis for estimating quite small probabilities of occurrence at the repository site. Consider, for example, a 10 km² repository site located within a 10,000 km² geologic setting. Events distributed randomly within the geologic setting, and with a recurrence interval of 10,000 years, would have a probability of occurrence at the repository site of only 10⁻⁷ per year. To the extent that potentially disruptive events can be considered random, the staff anticipates that this type of geometric consideration will be very significant in developing probability estimates.

Time factor. The time at which an event is postulated to occur is very important in evaluating its significance. First, radioactive decay rapidly reduces the radioactive inventory of some of the shorter-lived constituents of HLW. For events that disrupt only a very small fraction of a repository (e.g., drilling that strikes a waste canister) releases may not be significant unless the event occurs within the first few hundred years after repository closure. Second, the time lapse between the occurrence of an event and any resulting release may be quite long for a well-designed and sited repository. If, for example, the time for transport of released waste through the geosphere to the environment is 9000 years, only those events that occur within the first 1000 years after repository closure would be of regulatory significance in applying a 10,000-year standard. In both cases, the staff expects estimates of event probabilities to be more meaningful over these shorter time periods than they would be for 10,000 years.

In summary, there may be a difference of orders of magnitude between the probability that an event will occur and the probability that a release will result. Thus, in order to demonstrate that a release has a probability less than 1 chance in 1,000 over 10,000 years, it might only be necessary to show that the probability of an initiating event is less than 1 chance in 100,000 per year -- a short enough recurrence interval so that the geologic record should provide useful information. The predominant staff view is that meaningful, although not necessarily statistically rigorous, probability estimates can be made for repositories located at well-chosen sites -- i.e., sites that are not unusually complex or geologically active. In fact, the ability to develop the required probability estimates is a de-facto siting criterion for evaluating how well the site is understood and thus, how confident one can be of its future performance as part of a repository. As an example, the staffs of both DOE and NRC have been working to develop methods for predicting the probability of future volcanic activity at the Yucca Mountain, Nevada site, based on studies of the record of past volcanism near the site. These methods have been used to develop numerical estimates of site performance. The uncertainties in the probability estimates reflect technical concerns with the site which must be resolved before licensing, regardless of the standard which must be implemented to evaluate the site, rather than concerns with the ability to develop these numerical values. The NRC staff expressed its views in its comments on DOE's Site Characterization Plan (SCP), and additional discussions are planned for future meetings with DOE.

It is also possible to interpret the EPA standards to require a more rigorous statistical basis, in analyses incorporating significant conservatisms, for licensing. The only way to produce the required probability estimates would be to have available a site-specific geologic record approaching the age of the earth, and since such lengthy geologic records can seldom be found, rigid implementation of the EPA standards is likely to prove impossible. Also, the principal discussion has focused on geological examples. However, the EPA standard is not limited to geologic events but an entire spectrum of events that have the requisite likelihood. It can be extremely difficult to deal with the tail of a probability distribution of very large events with mean probabilities on the order of 10^{-7} to 10^{-8} /year. In the context of the EPA standard, it may also be difficult to deal with such things as climatic changes caused or affected by human activity over thousands

or years (e.g., greenhouse effect concerns resulting from increased fossil fuel use in recent decades).

Where from Here?

While the basic principles reflected in the EPA 1985 changes which recognized uncertainties and the need for non-quantifiable technical judgments in assuring repository performance remain valuable and important, additional clarification and guidance is required in order to deal with these issues. Specifically, additional clarification and guidance is needed to come to grips with how non-quantifiable technical judgments are to be used in assessing "reasonable expectation" of compliance with the governing numerical standard. The NRC staff has identified two basic courses of action available to the Commission -- (a) reaffirm its earlier acceptance of the probabilistic nature of the EPA standards provided that clarification of the treatment of key problem areas can be worked out (in this connection the staff will work closely with EPA to develop wording which could be used in either revised EPA standards or in NRC regulations, as appropriate, to minimize potential implementation problems and will remain alert to developments that could potentially alter this acceptance) or, (b) if the standards are now or subsequently judged not to be implementable, petition EPA to reissue the standards in an altered or non-probabilistic format. Combining these two basic courses of action with the prospect of developing implementing amendments to Part 60 has led the staff to identify the following four alternatives.

Alternative 1 -- Current EPA Standards and Part 60. In this alternative, the probabilistic portion of the EPA standards would be reissued with the same format as in 1985. The specific wording of the standards and of Part 60 would be revised only as necessary to resolve potential implementation problems and to ensure consistency between the two regulations. The main advantage of this alternative is that a complete set of regulatory standards could be established quickly, providing guidance to DOE for its repository development program. The main disadvantage of this alternative is that it might leave many contentious issues, such as acceptable methods for estimating the probabilities of disruptive events, to be resolved during a licensing review. The absence of clarification may make it virtually impossible to resolve difficult licensing issues within the three-year statutory time frame.

Alternative 2 -- Revised EPA Standards and Current Part 60
Several possible revisions to the EPA standards have been considered as ways to make the standards easier to implement. These include substitution of qualitative terms (likely, unlikely, etc.) for the numerical probabilities in the standards, restating the numerical probabilities in a less precise way (e.g., combining the numerical probabilities with modifiers such as "on the order of"), and making the standards consequence-based rather than risk-based (i.e., completely removing all probabilistic aspects of the standards). Amendments of these types might allow more flexibility for implementation of the EPA standards, but would be accompanied by significant uncertainties about interpretation of the standards. These greater uncertainties raise a different obstacle for the licensing process, namely, the lack of a clear standard of acceptability. The predominant view of the staff is that the current wording of the EPA standards represents a reasonable compromise between the goal of precise statement of the regulatory requirements of the standards and the desire for flexibility in implementing the standards. But, as discussed above, additional clarification and guidance is needed to address more clearly how non-quantifiable technical judgment may be used in lieu of or to fulfill the numerical standard. Since the fundamental issue is one of clarifying the EPA standard, this should be the responsibility of EPA, with substantial input from NRC concerning the specific nature of such clarification.

Alternative 3 -- Current or Revised EPA Standards and Revised Part 60. This alternative, which is currently being pursued by the staff, involves two phases. First, the staff will pursue an aggressive interaction with EPA during reissuance of its standards aimed at identification and resolution of potential implementation problems. To the extent possible the staff seeks to have EPA expand on its interpretation of the EPA standard. Second, the staff will amend Part 60 before a licensing review so as to resolve, where practicable, any remaining potentially contentious issues on implementation.³ The staff currently plans three rulemakings related to implementation of the EPA HLW standards (see SECY-88-285, October 5, 1988). One will provide the basis for making site-specific determinations on the potentially disruptive events and

³ Development of technical positions or regulatory guides, and interlocutory review by a licensing board for resolution of issues, are variations of this alternative.

processes that will need to be considered in developing HLW release scenarios. It will revise the current definitions of "anticipated" and "unanticipated" processes and events in Part 60. The revisions will specify a non-probabilistic method to be used for categorizing processes and events as "anticipated" or "unanticipated." The staff proposes this method because of its view that categorization on the basis of numerical probability estimates would be too uncertain to use as the primary basis for preliminary screening of events and processes.

A second rulemaking, referred to as the "conforming amendments," will incorporate directly into Part 60 all the substantive provisions of the EPA standards and will adopt any changes in terminology necessary for conformance between the two regulations. An earlier conforming rulemaking, previously discussed, was terminated when the EPA HLW standards were remanded by a decision of a Federal Appeals Court. The amendments currently contemplated will serve the same purpose as those previously initiated -- i.e., to reproduce within Part 60 all of the substantive requirements of the EPA standards and to eliminate any differences in terminology that might otherwise cause confusion during a licensing review.

As discussed earlier, it is the staff's intention to work closely with EPA during reissuance of its standards to reduce or eliminate, to the extent practicable, potential sources of confusion or contention about acceptable means for implementing the EPA standards. Nevertheless, the staff recognizes that it likely will not be possible for EPA to resolve all issues regarding the standards, and that an additional initiative by the NRC may be necessary. Thus, the staff is planning to pursue a third rulemaking, called the "implementing amendments," which is now only in the initial scoping phase. Possible topics to be addressed by this rulemaking include:

- 1) identification of acceptable methods for validation of the models and computer codes to be used for projecting repository performance;
- 2) specification of acceptable methods for estimating the likelihood of potentially disruptive processes and events, either generically or on a site-specific basis;

- 3) further elaboration, beyond that currently provided in Part 60, of the conditions for evaluating potential human-induced disruptions of a repository and of the need for incorporation of human-initiated releases into an overall probabilistic distribution of releases from a repository;
- 4) endorsement of an acceptable method for identifying potentially disruptive scenarios for analysis, and specification of criteria for screening out scenarios with low likelihood or consequences; and
- 5) elaboration on the meaning of the Section 60.122 requirements for evaluation of "favorable" and "potentially adverse" conditions -- especially the requirement to show that a potentially adverse condition does not compromise the ability of the geologic repository to meet the performance objectives relating to isolation of the waste.

The advantage of this alternative is that it permits resolution of certain potentially contentious issues before a licensing review, so that those issues will not delay or prevent a licensing decision on repository acceptability. The disadvantage of this alternative is the significant amount of time and staff resources required to develop and promulgate the necessary amendments to Part 60. Since the purpose and effect of these NRC rules is the implementation of the EPA standards, EPA endorsement of such NRC implementation would minimize the potential for protracted litigation over whether such NRC rules are consistent with NRC's statutory obligation to be consistent with EPA standards. Preferably, EPA should clarify its standards or amplify the Supplementary Information accompanying its regulation in a manner consistent with the thrust of NRC's "implementing regulations."

Alternative 4 -- No EPA Standards and Current or Revised Part 60. This alternative is included because of the possibility that EPA might be significantly delayed in reissuing its standards, or that the standards might again be found legally inadequate by a court. If there should be no EPA HLW standards in place at the time a repository license application is received, NRC could still carry out its licensing review, relying on Sections 60.31 and 60.41 as the criterion for overall system performance (no unreasonable risk to public health and safety). Doing so would, however, inject a significant uncertainty concerning the level of risk that would be considered "unreasonable."

To prevent this from occurring, NRC could add to Part 60 a more precise criterion for overall system performance. The staff does not now favor this alternative, and assumes that the EPA standards will be available when they are needed. The staff will monitor EPA's progress in reissuing its standards and, if significant delays become evident, will reevaluate the desirability of pursuing this alternative. The staff will also keep abreast of developments regarding implementation of the EPA standards for DOE's WIPP as part of its continuing evaluation of the standards.⁴

Evaluation of Alternatives

As previously discussed, the EPA standards already contain wording allowing considerable flexibility for implementation. Alternatives that further increase flexibility suffer from a lack of precision in their statements of the safety levels to be achieved (e.g., replacing numerical probabilities with "likely," "unlikely," or "credible"). Additional flexibility might prove counterproductive because a licensing review would need to interpret the meaning of the standards as well as consider whether compliance with the standards has been achieved. What is needed is clarification of how the flexibility provided by some of the wording in the rule and in the Supplementary Information accompanying the 1985 revision may be used in satisfying the governing numerical standard. Rather than petition EPA for major revisions to the probabilistic format, the staff recommends an aggressive effort to work closely with EPA to identify potential implementation problems in the standards and to develop solutions to those problems which can be incorporated by EPA in the standards when they are reissued. To the extent that this strategy is successful, the breadth of issues needing NRC resolution as discussed in Alternative 3, above, will be minimized.

⁴ The EPA standards also apply to facilities used for disposal of transuranic wastes -- the type of wastes to be emplaced at WIPP -- and DOE must prepare probabilistic analyses to demonstrate compliance of WIPP with the standards. EPA's comments on a draft Supplemental Environmental Impact Statement (EIS) for WIPP urge DOE to publish an additional supplemental EIS or similar compliance document for public review and comment after the planned five-year test phase and before initiation of the final disposal phase of operations. NRC staff review of DOE's iterative performance assessments for WIPP, which will be necessary to support the compliance document, could provide additional valuable insights into the implementability of the EPA standards.

The NRC staff recommends continued pursuit of Alternative 3, and approval of this recommendation is requested.

DOE's Plans

The SCP for the Yucca Mountain site, recently reviewed by NRC staff, describes in general terms DOE's plans for implementing the EPA standards. These plans involve identification of potentially disruptive processes and events (several dozen are described in the SCP), grouping these into scenarios or "scenario classes," evaluating radionuclide releases to the environment for each scenario or scenario class, and combination of the resulting information into a "complementary cumulative distribution function" (CCDF), for evaluation of compliance with the EPA standards. DOE's plans correspond well with the staff's views of the requirements of the EPA standards. It should be noted that the Technical Review Board's (TRB) Subcommittee on Performance Assessment is reviewing DOE's plans for implementing the EPA standards.

If the Standards Are Not Implementable

Although EPA considers its standards to be implementable, EPA recognizes that doubts continue to remain about implementation of the EPA standard. As a result, provisions for development of alternative standards have been incorporated. The Federal Register text (50 FR 38074, September 19, 1985) describing the alternative standards provision, stated:

There are several areas of uncertainty the Agency [EPA] is aware of that might cause suggested modifications of the standards in the future. One of these concerns implementation of the containment requirements for mined geologic repositories. This will require collection of a great deal of data during site characterization, resolution of the inevitable uncertainties in such information, and adaptation of this information into probabilistic risk assessments. Although the Agency is currently confident that this will be successfully accomplished, such projections over thousands of years to determine compliance with an environmental regulation are unprecedented. If -- after substantial experience with these analyses is acquired -- disposal systems that clearly provide good isolation cannot reasonably be shown to comply with the containment requirements, the Agency would

consider whether modifications to [the standards] were appropriate.

Any NRC staff position that the EPA standards can be implemented depends upon the flexibility for NRC to develop and apply non-probabilistic criteria consistent with the Commission's traditional multiple-barrier, defense-in-depth licensing philosophy, and the ability to work with EPA to identify and resolve potential issues regarding implementation. The staff anticipates that this resolution will consist of modifications to the EPA standards and NRC rulemakings. However, if this strategy should fail to resolve open issues and if implementation of the EPA standards should prove unworkable for a repository that otherwise appears suitable, EPA appears to be committed to reexamine its standards and, presumably, to modify those standards as needed to allow a reasoned licensing decision to be reached. Application of the standards to WIPP will be an additional test of the standards and should help to resolve questions about the standards, independent of a formal NRC licensing review.

Conclusions:

The predominant view of the staff is that the technical scope of a repository licensing review will be the same regardless of the way in which the EPA standards are formulated. If one is to reevaluate the use of quantitative licensing standards for the HLW repository, such a reevaluation cannot be done separately, but only by a thorough evaluation of the procedures and controls for use of such standards in the regulatory process. Thus, it is the further view of the staff that resolution of implementation concerns through close interaction with EPA during reissuance of its standards, followed by the technical development and rulemaking process described in SECY 88-285 is the essential path of such reevaluation.

Regarding potential releases from a repository, the fundamental purpose of the licensing review is to answer the questions:

--What can go wrong with a repository?

--What are the effects on public health and the environment if these things happen?

--How likely is it that they will occur?

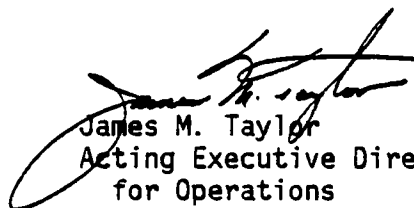
The likelihood of potential repository disruptions must be evaluated in some manner, and EPA's approach of combining numerical probabilities with wording allowing substantial reliance on qualitative considerations appears to be workable in a licensing review. DOE bears the "burden of proof" of compliance with the standards. If NRC's or DOE's experience in attempting to implement EPA's standards demonstrates serious difficulties in implementing the standards, EPA appears to be committed to reexamine the standards and to modify them, as needed, to allow a reasoned licensing decision to be reached. NRC staff will ensure that EPA is promptly informed of any such difficulties based on NRC's experience.

Recommendation:

That the Commission approve staff plans to pursue a long-term, ongoing evaluation of the EPA standards by way of its implementing rulemakings and, as it does so, to maintain close contact with EPA to identify and resolve, within the EPA standards, potential implementation issues to the extent practical.

Coordination:

The Office of the General Counsel has reviewed this paper and has no legal objection. The Office of Nuclear Regulatory Research has also reviewed and concurred in this paper. The Advisory Committee on Nuclear Waste (ACNW) and its predecessor, the Waste Management Subcommittee of the Advisory Committee on Reactor Safeguards (ACRS) have expressed reservations about the implementability and about the stringency of the EPA HLW standards. Pertinent correspondence is enclosed.



James M. Taylor
Acting Executive Director
for Operations

Enclosure:

ACRS and ACNW Correspondence Related
to EPA HLW Standards

Commissioners' comment or consent should be provided directly to the Office of the Secretary by COB Tuesday, October 31, 1989.

Commission Staff Office comments, if any, should be submitted to the Commissioners NLT Tuesday, October 24, 1989, with an information copy to the Office of the Secretary. If the paper is of such a nature that it requires additional time for analytical review and comment, the Commissioners and the Secretariat should be apprised of when comments may be expected.

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

WM

July 17, 1985

Honorable Nunzio J. Palladino
Chairman
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Dr. Palladino:

SUBJECT: ACRS COMMENTS ON EPA STANDARDS FOR HIGH-LEVEL RADIOACTIVE WASTE DISPOSAL

During its 303rd meeting, July 11-13, 1985, the Advisory Committee on Reactor Safeguards discussed the proposed "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes" (40 CFR 191), being developed by the U. S. Environmental Protection Agency (EPA). This was also the subject of a meeting of our Waste Management Subcommittee on June 18, 1985, during which discussions were held with staff members from both the EPA and the NRC. The Committee also had the benefit of the documents referenced.

Although we noted a number of questions relating to the proposed standards, a key issue pertains to the application of probabilistic conditions on the proposed radionuclide release limits. In this regard, we wish to call attention to a particular recommendation made by the High-Level Radioactive Waste Disposal Subcommittee of the EPA Science Advisory Board, namely:

"We recommend that use of a quantitative probabilistic condition on the modified Table 2 release limits be made dependent on EPA's ability to provide convincing evidence that such a condition is practical to meet and will not lead to serious impediments, legal or otherwise, to the licensing of high-level-waste geologic repositories. If such evidence cannot be provided, we recommend that EPA adopt qualitative criteria, such as those suggested by the NRC." (Reference 2)

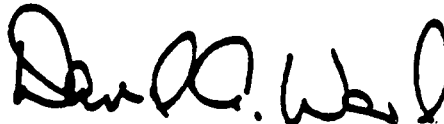
It is our understanding that the NRC Staff has concurred with the proposed EPA standards, including the use of a probabilistic approach on radionuclide release limits. In view of the importance of the ability of the NRC to determine compliance with the EPA standards in licensing a high-level waste repository, we recommend that the Commission assure itself that the NRC Staff is correct in endorsing this approach. We believe that demonstration of such compliance will be extremely difficult and that the proposed standards are unduly restrictive.

Dr. David Okrent, ACRS member, and Drs. Konrad Krauskopf and Frank Parker, ACRS consultants, who participated in the ACRS discussions on this matter, were

July 17, 1985

also involved in the review conducted by the EPA Science Advisory Board of an earlier version of the proposed standards.

Sincerely,



David A. Ward
Chairman

References:

1. EPA Working Draft No. 6 -- Final 40 CFR 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," dated June 15, 1985
2. Letter from H. E. Collier, Subcommittee Chairman, to W. D. Ruckelshaus, EPA Administrator, dated February 17, 1984 forwarding, "Report on the Review of Proposed Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes (40 CFR 191)" by the High-Level Radioactive Waste Disposal Subcommittee, Science Advisory Board, EPA, dated January 1984
3. SECY-84-320 for the Commissioners from W. J. Dircks, EDO, Subject: NRC Staff Comments to Environmental Protection Agency (EPA) on the Science Advisory Board Report on Proposed EPA Standard for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Waste (40 CFR Part 191), dated August 9, 1984
4. Letter from J. G. Davis, NRC Staff, to EPA, Subject: Response to EPA's request for comments on their proposed environmental standards for management and disposal of spent nuclear fuel, high-level and transuranic radioactive wastes, dated May 10, 1983
5. Letter from N. J. Palladino, Chairman, NRC, to L. Verstandig, Acting Administrator, EPA, Subject: Commission's concerns about sections of the proposed standards that deal with means of implementation, dated May 11, 1983

SEP 11 1985 - 1 -

MEMORANDUM FOR: R. F. Fraley, Executive Director
Advisory Committee on Reactor Safeguards

FROM: Robert E. Browning, Director
Division of Waste Management

SUBJECT: NRC STAFF VIEWS ON IMPLEMENTATION OF THE EPA HLW STANDARDS

Your memorandum of July 29, 1985 to William J. Dircks forwarded the ACRS comments on the EPA standards for disposal of high-level radioactive wastes. I would like to provide you with additional information regarding the staff's views on EPA's standards and on implementation of those standards by the NRC.

The ACRS's concerns are capsulized in the following paragraph from David A. Ward's July 17, 1985 memorandum to Chairman Palladino:

It is our understanding that the NRC Staff has concurred with the proposed EPA standards, including the use of a probabilistic approach on radionuclide release limits. In view of the importance of the ability of the NRC to determine compliance with the EPA standards in licensing a high-level waste repository, we recommend that the Commission assure itself that the NRC Staff is correct in endorsing this approach. We believe that demonstration of such compliance will be extremely difficult and that the proposed standards are unduly restrictive.

The NRC staff recognizes that use of numerical probabilities by EPA represents a novel approach for setting environmental standards. NRC comments on the proposed standards stated "The numerical probabilities in (the proposed standards) would require a degree of precision which is unlikely to be achievable in evaluating a real waste disposal system." In discussions following publication of the proposed standards, the NRC staff explained to EPA the difficulties foreseen in trying to implement a standard containing numerical probabilities. As a result of these discussions, EPA has added a new paragraph to Section 191.13 of the standards which reads as follows:

"Performance assessments need not provide complete assurance that the requirements of 191.13(a) will be met. Because of the long time period involved and the nature of the events and processes of interest, there will inevitably be substantial uncertainties in projecting disposal system performance. Proof of the future performance of a disposal system is not to be had in the ordinary sense of the word in situations that

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deal with much shorter time frames. Instead, what is required is a reasonable expectation, on the basis of the record before the implementing agency, that compliance with 191.13(a) will be achieved."

The staff considers that this wording (which conforms closely to §60.101(a)(2) of the Commission's regulations) sets reasonable bounds on the degree of assurance required for estimates of the likelihood and consequences of potentially disruptive events and processes. The Commission will not need to place sole reliance on probabilistic analyses when evaluating repository safety but, rather, will have considerable opportunity to employ its more traditional analytical and engineering methods. The staff considers that the specific performance objectives of 10 CFR Part 60, the detailed siting and other qualitative criteria of 10 CFR Parts 60 and 960, and the technical positions under development by the NRC staff will help assure that the appropriate balance is struck between use of traditional analytical and engineering methods and probabilistic analyses in making licensing findings. Although the staff continues to believe that the probabilistic nature of the standards will pose a significant challenge, the staff considers that the standards, in the current form, can be implemented in a licensing review.

I hope that this information proves helpful in explaining the staff's views regarding implementation of the EPA standards by the NRC.

Robert E. Browning, Director
Division of Waste Management

CC : WMRP	: WMRP	: WMRP	: WM	: WM	:	:
ME : DFehringer	: SCoplan	: HMiller	: MBell	: RBrowning	:	:
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

October 16, 1985

Honorable Nunzio J. Palladino
Chairman
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Dr. Palladino:

SUBJECT: ADDITIONAL ACRS COMMENTS ON THE EPA STANDARDS FOR A HIGH-LEVEL RADIOACTIVE WASTE REPOSITORY

During its 306th meeting, October 10-12, 1985, the Advisory Committee on Reactor Safeguards met with you and the other Commissioners to offer comments regarding the Environmental Protection Agency (EPA) Standards for a High-Level Radioactive Waste (HLW) Repository, which was the subject of our report to you dated July 17, 1985. In response to the request made during this meeting, we are pleased to submit the following additional comments on the EPA standards which were published as a final rule on September 19, 1985. These standards will apply to the facilities being proposed by the Department of Energy and must be met in the associated licensing review conducted by the NRC.

Our purpose in writing you at this time is to highlight the fact that the standards being promulgated by the EPA are unreasonably restrictive and contain serious deficiencies. This will undoubtedly introduce unnecessary obstacles into the licensing process for an HLW repository, with only minimal benefit to the public health and safety. Our justifications for these comments are outlined below.

Development of these standards has been under way within the EPA since December 1976. During this period, the ACRS and its Subcommittee on waste management were briefed periodically by EPA representatives, and at each such meeting comments and suggestions were discussed on an informal basis. In early 1983 the EPA submitted the then-current draft of the proposed standards to its Science Advisory Board (SAB) for review. Detailed comments by the High-Level Radioactive Waste Disposal Subcommittee of the SAB included the following:

The Subcommittee recommended "that the release limits specified in . . . the proposed standards be increased by a factor of ten, thereby causing a related tenfold relaxation of the proposed societal objective (population risk of cancer)."

The Subcommittee recommended "that use of a quantitative probabilistic condition on the . . . release limits be made dependent on EPA's ability to provide convincing evidence that such a condition is practical to meet and will not lead to serious impediments, legal or otherwise, to the licensing of high-level-waste geologic

October 16, 1985

repositories. If such evidence cannot be provided, we recommend that EPA adopt qualitative criteria, such as those suggested by the NRC."

Of particular concern to the SAB Subcommittee, in terms of meeting the conditions of the standards, was the fact that containment requirements should be such that the cumulative releases of radionuclides from a repository to the accessible environment for 10,000 years after disposal, from all significant processes and events that may affect the disposal system, shall:

"have a likelihood of less than one chance in 10 of exceeding" the quantities (given in an accompanying Table); and

"have a likelihood of less than one chance in 1,000 of exceeding ten times" these same quantities.

The SAB Subcommittee also recommended specific changes in the probabilistic aspects of the draft standards to help make it more practical for an applicant to make a case that the quantitative probabilistic criteria had been met.

Although the wording in the standards includes the statement that "performance assessments need not provide complete assurance" that these requirements will be met, there remains the basic fact that the standards, as published, are far too restrictive. In our opinion, the establishment of overly restrictive standards, relieved by leniency in their implementation, is not an appropriate approach. The proper approach would have been to develop reasonable standards that could have been more definitively enforced.

The problems cited above were but a few of those observed and commented upon by the SAB Subcommittee. Additional problems in Working Draft No. 6 of the EPA standards were discussed with an EPA representative during a meeting of the ACRS Subcommittee on waste management on June 18 and 19, 1985. These included the following:

The standards, as published, do not appear to be internally consistent. Although the latest data were used for estimating the biological effects of various radionuclides, the associated dose limits for individual body organs were not based on appropriate risk criteria.

The health risks associated with the release limits specified in the standards are much lower (by factors of a thousand or more) than the risks considered acceptable by the EPA for other environmental stresses, such as hazardous toxic chemicals.

The overly restrictive standards may result in the rejection of some sites proposed for an HLW repository that otherwise might be acceptable.

October 16, 1985

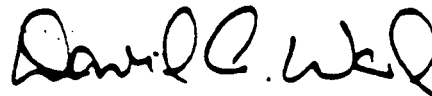
As indicated above, the standards will definitely complicate the processes, both technical and legal, of demonstrating that a given site is acceptable.

We realize that both the NRC Staff and the DOE Staff have accepted the EPA standards. Although we can understand, to some degree, the desires of both staffs to complete this step, we are troubled by the serious deficiencies that exist in the standards. The compromises that have been made at this stage will lead to extended delays and an uncertain outcome in the licensing process for an HLW repository, with only slight benefit to the public health and safety.

Although the ACRS could undertake a more detailed review and critique of the EPA standards, we believe that the SAB Subcommittee has already done this in a professional manner. A copy of the Executive Summary of their report is attached for your information.

We hope this letter is helpful. Although we realize that the EPA standards have been published, we believe that they contain such serious deficiencies that the NRC should take prompt action to voice these concerns.

Sincerely,



David A. Ward
Chairman

Attachment:

Section II, "Executive Summary" of Report on the review of Proposed Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes (40 CFR 191) by the SAB, EPA, dated January 1984

References:

1. Letter from Herman E. Collier, Jr., Chairman, EPA High-Level Radioactive Waste Disposal Subcommittee, to Mr. William D. Ruckelshaus, Administrator, EPA, dated February 17, 1984 transmitting Report on the review of Proposed Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes by the High-Level Radioactive Waste Disposal Subcommittee, Science Advisory Board, EPA, dated January 1984
2. SECY-84-320, "NRC Staff Comments to EPA on the SAB Report on Proposed EPA Standard for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Waste (40 CFR Part 191)," dated August 9, 1984, including Working Draft No. 8, Final 40 CFR 191, Subchapter F - Radiation Protection Programs, dated July 19, 1985

October 16, 1985

3. SECY-85-272, "Report on the EPA's Environmental Standards for High-Level Radioactive Waste Disposal," dated August 13, 1985
4. Memorandum from R. E. Browning, Director, Division of Waste Management, to R. F. Fraley, ACRS, Subject: NRC Staff Views on Implementation of the EPA HLW Standards, dated September 11, 1985

NRC STAFF VIEWS
REGARDING THE FINAL
EPA HIGH-LEVEL WASTE STANDARDS
OCTOBER 21, 1985

EPA HIGH-LEVEL WASTE STANDARDS ISSUES

- ARE THE EPA STANDARDS OVERLY CONSERVATIVE, ESPECIALLY COMPARED WITH STANDARDS IN OTHER AREAS?
- CAN THE PROBABILISTIC FEATURES OF THE STANDARDS BE IMPLEMENTED IN A FORMAL LICENSING REVIEW?

SUMMARY

- NRC WAS INTENSELY INVOLVED FOR NINE YEARS IN REVIEWING THE DEVELOPMENT OF THE EPA HIGH-LEVEL WASTE STANDARDS.
- INDEPENDENT NRC STUDIES HAVE SHOWN THE STANDARDS TO BE ACHIEVABLE.
- EPA SIGNIFICANTLY MODIFIED THE STANDARDS TO ALLOW QUALITATIVE JUDGMENTS IN LICENSING REVIEWS.
- AS NOTED IN SECY-85-272, EPA HAS BEEN RESPONSIVE TO NRC'S CONCERNS REGARDING THE ABILITY TO IMPLEMENT THE STANDARDS.
- SINCE SECY-85-272, NO NEW ISSUES HAVE ARISEN WHICH WOULD ALTER THE CONCLUSIONS OF THAT PAPER.

WHO HAS REVIEWED THE STANDARDS

NRC -- REVIEWED THROUGHOUT EPA'S DEVELOPMENT. COMMISSION
REVIEWED AND REVISED STAFF COMMENTS ON PROPOSED STANDARDS.

DOE -- INTERACTED WITH EPA, PARALLEL TO THE NRC'S REVIEWS.

STATES AND TRIBES -- INTENSE SCRUTINY FOLLOWING PUBLICATION OF
PROPOSED STANDARDS.

OMB -- SIGNIFICANT SCRUTINY OF THE PROPOSED STANDARDS PRIOR TO
PUBLICATION. LESS INVOLVEMENT PRIOR TO FINAL PUBLICATION.

EPA SCIENCE ADVISORY BOARD -- SUBCOMMITTEE WAS FORMED TO REVIEW
PROPOSED STANDARDS. SAB REPORT REVIEWED BY NRC STAFF, AND
COMMENTS FORWARDED TO COMMISSION (SECY-84-320).

ACRS -- ACRS AND ITS WASTE MANAGEMENT SUBCOMMITTEE PERIODICALLY
BRIEFED ON STANDARDS.

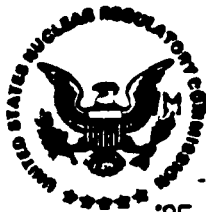
BASES FOR NRC STAFF POSITIONS

CONSERVATISM

- EPA HAS LEGAL RESPONSIBILITY TO DETERMINE ALLOWABLE LEVEL OF HEALTH EFFECTS.
- NRC STAFF CONSIDERS STANDARDS TO BE ACHIEVABLE BASED ON NUREG/CR-3235.
- STANDARDS CAN BE VIEWED AS A QUANTIFICATION OF "AS LOW AS REASONABLY ACHIEVABLE," GIVEN CURRENT UNCERTAINTIES.

PROBABILISTIC FEATURES

- NRC STAFF PROPOSED WORDING TO PERMIT QUALITATIVE LICENSING FINDINGS WHERE NECESSARY. EPA INCORPORATED WORDING IN STANDARDS. WORDING IS NOT VIEWED AS COMPENSATION FOR EXCESS CONSERVATISM IN THE STANDARDS.
- EPA RULE CONFORMS TO COMMISSION'S DISTINCTION BETWEEN QUANTITATIVE PERFORMANCE STANDARDS AND QUALITATIVE STATEMENTS REGARDING LEVELS OF CONFIDENCE (48 FR 28204).



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WASHINGTON, D.C. 20555

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

October 25, 1985

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Dircks
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Stello
Davis
Denton
Minogue
GCunningham
EDO R/F

MEMORANDUM FOR: Samuel J. Chilk, Secretary
FROM: Lando W. Zech, Jr.
SUBJECT: SECY 85-272

WM Record File

406-3.3

WM

Docket No.

PDR

LPDR

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MEK JTB

(Return to WM, 623-SS)

I have reviewed and carefully considered the ACRS' advice that the EPA standards, in the opinion of the ACRS, are "unreasonably restrictive and contain serious deficiencies" together with their conclusion that the standards "will undoubtedly introduce unnecessary obstacles into the licensing process." I have also considered the DOE and EPA statements in support of the standards and their conclusion that the standards are reasonable and achievable. The NRC staff has concluded that the EPA standards are reasonable, achievable and flexible enough that they can be implemented.

In view of the conflicting advice provided to the Commission, OGC has provided options which the Commission may exercise and concluded that since "the ACRS concerns [are] governed by the policy and technical issues we have described rather than any strictly legal considerations, we make no recommendation on how the Commission should proceed, other than that it should not act without hearing from the NRC staff and fully assessing all the factors we have described." The staff has responded to the Commission at the October 21, 1985 public meeting and addressed the ACRS concerns. The staff has advised the Commission that the staff, as well as DOE and EPA, do not agree with the ACRS that the standards are overly restrictive and contain serious deficiencies. The staff stated that they believed, as did DOE and EPA, that the standards were flexible enough and could be executed.

With all due respect to the advice of the ACRS, I reaffirm my approval of SECY-85-272 in support of the DOE, EPA and staff recommendation.

However, I suggest that the staff be directed to address the ACRS' concerns when developing the package conforming Part 60 to the EPA standards. I understand they may do this by defining the basis for their assurance that adequate flexibility exists in the standards for them to be implemented.

cc: Chairman Palladino
Commissioner Roberts
Commissioner Asselstine
Commissioner Zech

EDO
ACRS

LANDO

I AGREE

[Signature]
10-25-85



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

November 14, 1985

35 15 11 13

Honorable Nunzio J. Palladino
Chairman
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

WM Record File

406-3.3

WM Project

Docket No.

PDR

LPOR

Distribution:

REP M-B
JDB *HJM

(Return to WM, 623-SS)

* Boyle MRR
FEBRINGER

Dear Dr. Palladino:

SUBJECT: ADDITIONAL ACRS COMMENTS ON EPA STANDARDS FOR A HIGH-LEVEL
RADIOACTIVE WASTE REPOSITORY

During its 307th meeting, November 7-9, 1985, the Advisory Committee on Reactor Safeguards met with members of the NRC Staff and the Environmental Protection Agency (EPA) for additional discussions on the nature and implementation of the EPA Standards for a High-Level Radioactive Waste (HLW) Repository. This was also the subject of a meeting of the NRC Commissioners with the ACRS on October 10, 1985; of a meeting of the NRC Commissioners with representatives of the NRC Staff, the Department of Energy (DOE), EPA, and the ACRS on October 21, 1985; and of a combined meeting of our subcommittees on Waste Management and Metal Components on October 24-25, 1985. In addition, we reported to you on this subject in our letters of July 17, 1985 and October 16, 1985.

As a result of these meetings and associated discussions, we offer the following additional comments.

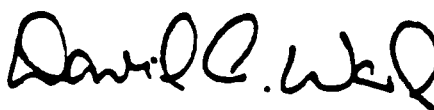
1. It is generally recognized that there is essentially no prospect that compliance with the EPA Standards can ever be demonstrated by actual observations. Determination of compliance will have to be based on the results of calculations using some agreed-upon set of release scenarios, environmental transport models, and their underlying assumptions. As stated in our letter of October 16, 1985, we believe that this has the potential for introducing obstacles in the licensing process, and it was for this reason that we recommended in our letter of July 17, 1985, that the Commission assure itself that the Staff's endorsement of this approach was correct.
2. We continue to believe that the EPA Standards contain deficiencies and inconsistencies, e.g., that the dose limits for single organs are not risk-based, and that different dose limits are being applied to NRC-licensed HLW facilities than to similar DOE facilities. Although we understand that time constraints did not permit the EPA Staff to correct these deficiencies, they nonetheless exist. In addition, there are errors in the recommended methods for the analysis and interpretation of data collected in the evaluation of the performance of a repository.

November 14, 1985

The NRC Staff is proposing an approach that may prove successful. However, we have no confidence that it will succeed. Our basic concern continues to be whether a formal determination can be made that a licensee is complying with the EPA Standards. To help resolve this problem, we encourage the NRC Staff to accelerate their efforts to develop analytical methods based on both deterministic and probabilistic approaches, and we recommend that a consensus be sought on these methods as they are developed. We also encourage the NRC Staff to use rule-making as a mechanism for implementing these methods, and we support the approaches being developed by the NRC Staff to utilize outside experts to help identify relevant issues and information needs.

Additional comments by ACRS Members Harold W. Lewis and Dade W. Moeller are presented below.

Sincerely,



David A. Ward
Chairman

Additional Comments by ACRS Member Harold W. Lewis

It is worth repeating and extending the statement in the ACRS letters of July 17, 1985 and October 16, 1985, that the EPA Standards are too stringent. All these problems of compliance determination derive from the fact that the EPA risk limits are far below any reasonable likelihood of detection. It is that that drives the dependence on models and calculations.

I know of no rational basis (though recognize the political constraints) for a standard involving one-tenth of a fatality per year for ten thousand years, beginning in a few hundred years. If one uses cost/benefit analysis with any reasonable estimate of the benefit of the repository; if one uses reasonable discounting of future costs against current benefits, a procedure understood by all surviving businesses and nations; if one compares with the risk or even the radioactive effluents from coal burning, the only viable alternative to nuclear power; if one compares with cosmic rays or other natural radiation; however one makes the comparison, these are unreasonably stringent standards.

I recognize that they are the product of EPA, and the result of a necessary political process, but think that the NRC should develop regulatory procedures in such a way as to make the best of a bad set of standards by moving the assessment of the risk in the direction of realism. To add the usual regulatory conservatism to the implementation of standards which are already too stringent would not be in the national interest.

I know of no risk issue (perhaps excepting UFOs) in which the discrepancy between perceived risk and actual risk is so high. That seems to be what has put us in this position, but it is still the responsibility of scientific advisors to remain rational and to deal with real risk. That is extraordinarily small here.

Additional Remarks by ACRS Member Dade W. Moeller

I recognize that many of the issues associated with the EPA Standards are controversial and subject to a range of interpretations. A primary example is the estimation of the average annual societal risk to an individual as a consequence of the operation of an HLW repository constructed and operated in accord with the EPA Standards. Depending on the number of people assumed to be exposed, one can "demonstrate" that the Standards are either comparable to the risks associated with some other existing radiation standards, or that the risks are several orders of magnitude lower. Since, at the present time, there appear to be no acceptable guides for use by Federal agencies in making risk estimates for radionuclide sources that have the potential for exposing large numbers of people at extremely low dose rates over long periods of time, I would encourage the NRC to request that the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC) undertake to develop such guides. I understand that the CIRRPC would be receptive to such a request.



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

November 20, 1985

WM Record File

406.3.3

Dircks
Roe
Rehm
Stello
Davis

WM Project
Docket No. EDO-R/F
PDR
LPDR

MEMORANDUM FOR: Samuel J. Chilk, Secretary

FROM: Frederick M. Bernthal

SUBJECT: REAFFIRMATION OF VOTE ON SECY-85-272

Distribution:

REB MJB

IOB JJS

(Return to WM 623-SS)

HJM
MRK
JTG
Fehringer
Sue

Upon extensive examination of the ACRS objections to the EPA standard (including their most recent comments presented in a letter of 11/14/85) and of the analysis of available Commission options presented by OGC, I reaffirm my approval of SECY-85-272.

The ACRS has criticized the EPA standard on the grounds that

1. it is overly stringent, mandating a level of protection that is far in excess of that provided by other existing environmental standards, and
2. implementation of the standard by NRC in licensing a repository will be difficult if not impossible.

My review of the question suggests that the momentary confusion over the EPA standard arose from imprecise wording on the part of EPA and Staff in attempting to explain the origin of the cumulative probability distribution function of repository release upon which the interpretation of 40 CFR 191 is based. Nevertheless, I continue to have reservations, both as to the application of the EPA standard, and as to the reasonableness and consistency of the standard when viewed in light of other societal risks (cf. comments of ACRS Members Dade Moeller and Hal Lewis).

Be that as it may, the Nuclear Waste Policy Act clearly assigns to the EPA the responsibility for establishing the environmental standard. Given that our staff has repeatedly asserted that the standards as published can be implemented, there appears to be little basis on which to challenge a policy decision that is, strictly speaking, that of EPA.

But I agree with the suggestion of ACRS Member, Dr. Dade Moeller that the Commission request the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC) to develop guidelines for use by Federal agencies that would foster consistency in the risk estimates and risk management of low doses of radiation.

I also agree with Commissioner Zech and the Chairman that any remaining ACRS concerns should be addressed to the fullest extent possible in the rulemaking that will be necessary to conform Part 60 to the EPA standard. In particular, care should be taken to avoid any ambiguity in the application of probabilistic conditions placed on the post-closure containment requirements.

The application of these conditions should not impose any further conservatism on an already highly conservative standard.

It is unfortunate that the ACRS comments on the EPA standards were made available at a time when Commission options to act without seriously delaying the repository program had, for the most part, been foreclosed. I would hope that in future reviews of NRC activities under the NWPA the ACRS could be involved at an earlier stage so that valuable technical advice and input could be used to timely and best advantage by the Commission.

cc: Chairman Palladino
Commissioner Roberts
Commissioner Asselstine
Commissioner Zech
OGC
OPE
EDO



OFFICE OF THE
SECRETARY

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

WM DOCKET CONTROL
CENTER

November 27, 1985

85 DEC -2 P12:25

Action: Minogue, RES/Davis, NM
Cys: Dircks
Roe
Rehm
Stello
GCunningham
Denton
Kerr, SP
Fehring, NMSS
Prichard, RES
Philips

MEMORANDUM FOR: William J. Dircks
Executive Director for Operations

FROM: Samuel J. Chilk, Secretary

SUBJECT: STAFF REQUIREMENTS - NOTATION VOTE ON
SECY-85-272 - REPORT ON THE ENVIRONMENTAL
PROTECTION AGENCY'S ENVIRONMENTAL
STANDARDS FOR HIGH-LEVEL RADIOACTIVE WASTE
DISPOSAL

On September 19, 1985, the Commission (with all Commissioners agreeing) approved the proposed letter to EPA, as attached. Immediately following Commission approval, the ACRS requested that this matter be discussed with the Committee. On October 21, 1985, the Commission met with the staff, ACRS and others to discuss conflicting views.

Upon due consideration of the concerns expressed by the ACRS and the responses by the staff, the Commission reaffirmed releasing the letter to EPA.

The letter has been forwarded to the Chairman for his signature.

In addition, EDO is directed to submit to the Commission the rulemaking package which conforms 10 CFR Part 60 with the EPA Standard. The Commission also stresses the importance for the staff to clearly articulate, in the changes to Part 60, how we interpret the EPA's Standards and that the ACRS' concerns be addressed by clearly defining the basis for the assurance that adequate flexibility exists in the standards for their implementation. In particular, care should be taken to avoid any ambiguity in the application of probabilistic conditions placed on the post-closure containment requirements. (RES)

(EDO Suspense: 2/15/86)

WM Record File
406.3.3

WM Project _____
Docket No. _____
PDR _____
LPDR _____

Rec'd Off. EDO
Date: 11-29-85
Time: 1:55 PM

Distribution:
RES MJB MRK JIG
JOB HIM JIS Fehring
JAC

The Commission also agrees that the staff and the ACRS should interact with each other early in the process of developing the package on 10 CFR Part 60 as well as in future reviews of NRC activities under the NWPA so that valuable technical advice and input can be used in a timely manner by the Commission.

Chairman Palladino requested, in line with ACRS comments, that EDO accelerate its efforts to develop analytical methods to be used in making a determination that a licensee is complying with the EPA Standards. These methods should receive as broad an input and review as possible. (NMSS)

Attachment:
As stated

cc: Chairman Palladino
Commissioner Roberts
Commissioner Asselstine
Commissioner Bernthal
Commissioner Zech
OGC
OPE
ACRS



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

The Honorable Lee Thomas
Administrator
U.S. Environmental Protection Agency
Washington, D.C. 20460

Dear Mr. Thomas:

On May 10 and 11, 1982 the Nuclear Regulatory Commission (NRC) submitted formal comments on the Environmental Protection Agency's proposed environmental standards for management and disposal of high-level radioactive wastes. Among other things, we stated our view that the proposed "assurance requirements" and "procedural requirements" contained in those proposed standards involved matters of implementation and thus went beyond the limits of EPA's jurisdiction.

In letters dated July 19 and August 15, 1984 Acting Chairman Roberts and Former Administrator Ruckelshaus, respectively, agreed that the staffs of EPA and NRC should attempt to develop modifications to 10 CFR Part 60 to incorporate the principles of EPA's proposed assurance and procedural requirements. EPA could then delete these requirements or make them applicable only to facilities not licensed by the NRC, eliminating any potential problems of jurisdictional overlap.

The NRC staff recently reported to the Commission several proposed changes to Part 60 which have been worked out by the NRC and EPA staff (text enclosed). Consistent with the provisions of the Administrative Procedure Act, the Commission will propose these changes for incorporation into Part 60 now that the final EPA high-level waste standards have been published. The NRC staff anticipates submittal of a rulemaking package, incorporating both these wording changes and other conforming amendments, to the Commission within 120 days.

The Commission appreciates the cooperation shown by the EPA staff in working to reach this agreement.

Sincerely,

Nunzio J. Palladino

Enclosure:
Proposed changes to
10 CFR Part 60

EPA ASSURANCE REQUIREMENTS AND

PROPOSED CHANGES TO PART 60

1.a. EPA Assurance Requirement:

(a) Active institutional controls over disposal sites should be maintained for as long a period of time as is practicable after disposal; however, performance assessments that assess isolation of the wastes from the accessible environment shall not consider any contributions from active institutional controls for more than 100 years after disposal.

(In Working Draft No. 8 "active institutional control" means: (1) controlling access to a disposal site by any means other than passive institutional controls, (2) performing maintenance operations or remedial actions at a site, (3) controlling or cleaning up releases from a site, or (4) monitoring parameters related to disposal system performance.)

b. Discussion:

The Commission's existing provisions (§60.52) related to license termination will determine the length of time for which institutional controls should be maintained, and there is therefore no need to alter Part 60 based on the first part of this assurance requirement.

The second part of this assurance requirement would require that "active" institutional controls be excluded from consideration (after 100 years) when the Commission assesses the isolation characteristics of a repository. The NRC staff understands that remedial actions (or other active institutional controls) would not be relied upon under Part 60 to compensate for a poor site or inadequate engineered barriers. However, in the definition of "unanticipated events and processes," Part 60 expressly contemplates that, in assessing human intrusion scenarios, the Commission would assume that "institutions are able to assess risk and to take remedial action at a level of social organization and technological competence equivalent to, or superior to, that which was applied in initiating the processes or events concerned" (emphasis added). Therefore, it might appear at first blush that Part 60 is at odds with the draft EPA standards.

2.a. EPA Assurance Requirement:

(b) Disposal systems shall be monitored after disposal to detect any substantial and detrimental deviations from expected performance. This monitoring shall be done with techniques that do not jeopardize the isolation of the wastes and shall be conducted until there are no significant concerns to be addressed by further monitoring.

b. Discussion:

Part 60 currently requires completion of a performance confirmation program prior to repository closure, but does not require monitoring during the period following closure but prior to license termination. The Commission chose not to require post-closure monitoring because of doubts about the usefulness of such monitoring and because of fears that monitoring in or near a repository after closure could degrade repository performance. The type of monitoring envisioned by EPA does not involve direct monitoring of the repository itself (which might degrade repository performance). Rather, EPA proposes monitoring of such parameters as regional groundwater flow characteristics. The NRC agrees that such monitoring may, in some cases, provide desirable information beyond that which would be obtained in the performance confirmation program which Part 60 now requires to be continued until permanent closure. The NRC therefore proposes to require monitoring as an extension of performance confirmation, as appropriate, when such monitoring can be conducted without degrading repository performance.

c. Proposed Changes to Part 60:

Add to §60.21(c) a new ¶ (9) as follows:

(9) A general description of the program for post-permanent closure monitoring of the geologic repository.

Renumber the current ¶ (9) through (15) accordingly.

Revise §60.51(a)(1) to read:

(1) A detailed description of the program for post-permanent closure monitoring of the geologic repository in accordance with §60.144. As a minimum, this description shall:

- (i) identify those parameters that will be monitored;
- (ii) indicate how each parameter will be used to evaluate the expected performance of the repository; and
- (iii) discuss the length of time over which each parameter should be monitored to adequately confirm the expected performance of the repository.

3.a. EPA Assurance Requirement:

(c) Disposal sites shall be designated by the most permanent markers, records, and other passive institutional controls practicable to indicate the dangers of the wastes and their location.

b. Discussion:

No revisions to Part 60 are needed. §60.21(c)(8), 60.51(a)(2), and 60.121 contain equivalent provisions.

5.a. EPA Assurance Requirement:

(e) Places where there has been mining for resources, or where there is a reasonable expectation of exploration for scarce or easily accessible resources, or where there is a significant concentration of any material that is not widely available from other sources, should be avoided in selecting disposal sites. Resources to be considered shall include minerals, petroleum or natural gas, valuable geologic formations, and ground waters that are either irreplaceable because there is no reasonable alternative source of drinking water available for substantial populations or that are vital to the preservation of unique and sensitive ecosystems. Such places shall not be used for disposal of the wastes covered by this Part unless the favorable characteristics of such places compensate for their greater likelihood of being disturbed in the future.

b. Discussion:

Part 60 contains provisions equivalent to this assurance requirement in §60.122(c)(17), (18) and (19). Part 60 does not, however, address "a significant concentration of any material that is not widely available from other sources."

It is possible that the economic value of materials could change in the future in a way which might attract future exploration or development detrimental to repository performance. The NRC proposes to add an additional potentially adverse condition to Part 60 related to significant concentrations of material that is not widely available from other sources. As with the other potentially adverse conditions, the presence of such a condition would require an evaluation of the effect of the condition on repository performance as specified in §60.122(a)(2)(ii), but would not preclude selection of a site for repository construction. (It should be noted that DOE's siting guidelines contain an identical provision in 10 CFR 960.4-2-8-1.)

c. Proposed Changes to Part 60:

Add a new § (18) to §60.122(c) as follows:

(18) The presence of significant concentrations of any naturally-occurring material that is not widely available from other sources.

Renumber the current § (18) through (21) accordingly.



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

WM DOCKET CONTROL
CENTER

December 2, 1985

'85 DEC -3 P3:13

The Honorable Lee Thomas
Administrator
U.S. Environmental Protection Agency
Washington, D.C. 20460

Cys: Dircks
Roe
Rehm
Stello
Davis
Minogue
Denton
GCunningham
Kerr, SP
Fehringer, NMSS
EDO R/F

Dear Mr. Thomas:

On May 10 and 11, 1982 the Nuclear Regulatory Commission (NRC) submitted formal comments on the Environmental Protection Agency's proposed environmental standards for management and disposal of high-level radioactive wastes. Among other things, we stated our view that the proposed "assurance requirements" and "procedural requirements" contained in those proposed standards involved matters of implementation and thus went beyond the limits of EPA's jurisdiction.

In letters dated July 19 and August 15, 1984 Acting Chairman Roberts and Former Administrator Ruckelshaus, respectively, agreed that the staffs of EPA and NRC should attempt to develop modifications to 10 CFR Part 60 to incorporate the principles of EPA's proposed assurance and procedural requirements. EPA could then delete these requirements or make them applicable only to facilities not licensed by the NRC, eliminating any potential problems of jurisdictional overlap.

The NRC staff recently reported to the Commission several proposed changes to Part 60 which have been worked out by the NRC and EPA staff (text enclosed). Consistent with the provisions of the Administrative Procedure Act, the Commission will propose these changes for incorporation into Part 60 now that the final EPA high-level waste standards have been published. The NRC staff anticipates submittal of a rulemaking package, incorporating both these wording changes and other conforming amendments, to the Commission within 120 days.

The Commission appreciates the cooperation shown by the EPA staff in working to reach this agreement.

Sincerely,

Nunzio J. Palladino
Nunzio J. Palladino

Enclosure:
Proposed changes to
10 CFR Part 60

WM Record File

406.3.3

WM Project

Docket No.

PDR

LPDR

(Originated by NMSS)

Distribution:

REB MIB HJM JTG

IOB MRK Dfehringer

(Return to WM, 623-SS)

Sac

EPA ASSURANCE REQUIREMENTS AND
PROPOSED CHANGES TO PART 60

1.a. EPA Assurance Requirement:

(a) Active institutional controls over disposal sites should be maintained for as long a period of time as is practicable after disposal; however, performance assessments that assess isolation of the wastes from the accessible environment shall not consider any contributions from active institutional controls for more than 100 years after disposal.

(In Working Draft No. 8 "active institutional control" means: (1) controlling access to a disposal site by any means other than passive institutional controls, (2) performing maintenance operations or remedial actions at a site, (3) controlling or cleaning up releases from a site, or (4) monitoring parameters related to disposal system performance.)

b. Discussion:

The Commission's existing provisions (§60.52) related to license termination will determine the length of time for which institutional controls should be maintained, and there is therefore no need to alter Part 60 based on the first part of this assurance requirement.

The second part of this assurance requirement would require that "active" institutional controls be excluded from consideration (after 100 years) when the Commission assesses the isolation characteristics of a repository. The staff understands that remedial actions (or other active institutional controls) would not be relied upon under Part 60 to compensate for a poor site or inadequate engineered barriers. However, in the definition of "unanticipated events and processes," Part 60 expressly contemplates that, in assessing human intrusion scenarios, the Commission would assume that "institutions are able to assess risk and to take remedial action at a level of social organization and technological competence equivalent to, or superior to, that which was applied in initiating the processes or events concerned" (emphasis added). Therefore, it might appear at first blush that Part 60 is at odds with the draft EPA standards.

The "remedial action" is not, however, the same in the two documents. The EPA standards have in mind a planned capability to maintain a site and, if necessary, to take remedial action at a site in order to assure that isolation is achieved. The staff agrees that such a capability should not be relied upon. The extent to which corrective action may be taken after an unanticipated intrusion occurs is an entirely different matter. The Commission may wish to consider, for example, the extent to which the application of the limited societal response capability assumed by the rule (e.g., sealing boreholes consistent with current petroleum industry practice) could reduce the likelihood of releases exceeding the values specified in the EPA standards, or could eliminate certain hypothetical scenarios such as systematic and persistent intrusions into a site.

The NRC and EPA staffs are in substantive agreement that planned remedial capabilities should not be relied upon for repository safety, and agree that the wording below should be proposed for public comment. The EPA staff may provide comment on this wording to help clarify the distinction between expected societal responses versus planned capabilities for remedial actions.

c. Proposed Changes to Part 60:

Add definitions to §60.2 as follows:

"Active institutional control" means: (1) controlling access to a site by any means other than passive institutional controls, (2) performing maintenance operations or remedial actions at a site, (3) controlling or cleaning up releases from a site, or (4) monitoring parameters related to geologic repository performance.

"Passive institutional control" means: (1) permanent markers placed at a site, (2) public records and archives, (3) government ownership and regulations regarding land or resource use, and (4) other methods of preserving knowledge about the location, design, and contents of a geologic repository.

Add a new §60.114 as follows:

§60.114 Institutional Controls

Neither active nor passive institutional controls shall be deemed to assure compliance with the overall performance objective set out at § 60.112 for more than 100 years after disposal. However, the effects of institutional controls may be considered in assessing, for purposes of that section, the likelihood and consequences of processes and events affecting the geologic setting.

2.a. EPA Assurance Requirement:

(b) Disposal systems shall be monitored after disposal to detect any substantial and detrimental deviations from expected performance. This monitoring shall be done with techniques that do not jeopardize the isolation of the wastes and shall be conducted until there are no significant concerns to be addressed by further monitoring.

b. Discussion:

Part 60 currently requires completion of a performance confirmation program prior to repository closure, but does not require monitoring during the period following closure but prior to license termination. The Commission chose not to require post-closure monitoring because of doubts about the usefulness of such monitoring and because of fears that monitoring in or near a repository after closure could degrade repository performance. The type of monitoring envisioned by EPA does not involve direct monitoring of the repository itself (which might degrade repository performance). Rather, EPA proposes monitoring of such parameters as regional groundwater flow characteristics. The staff agrees that such monitoring may, in some cases, provide desirable information beyond that which would be obtained in the performance confirmation program which Part 60 now requires to be continued until permanent closure. The staff therefore proposes to require monitoring as an extension of performance confirmation, as appropriate, when such monitoring can be conducted without degrading repository performance.

c. Proposed Changes to Part 60:

Add to §60.21(c) a new ¶ (9) as follows:

(9) A general description of the program for post-permanent closure monitoring of the geologic repository.

Renumber the current ¶ (9) through (15) accordingly.

Revise §60.51(a)(1) to read:

(1) A detailed description of the program for post-permanent closure monitoring of the geologic repository in accordance with §60.144. As a minimum, this description shall:

- (i) identify those parameters that will be monitored;
- (ii) indicate how each parameter will be used to evaluate the expected performance of the repository; and
- (iii) discuss the length of time over which each parameter should be monitored to adequately confirm the expected performance of the repository.

Add to §60.52(c) a new ¶ (3) as follows:

(3) That the results available from the post-permanent closure monitoring program confirm the expectation that the repository will comply with the performance objectives set out at §60.112 and §60.113; and

Renumber the current ¶ (3) as ¶ (4).

Add a new §60.144 as follows:

§60.144 Monitoring After Permanent Closure

A program of monitoring shall be conducted after permanent closure to monitor all repository characteristics which can reasonably be expected to provide material confirmatory information regarding long-term repository performance, provided that the means for conducting such monitoring will not degrade repository performance. This program shall be continued until termination of a license.

Include in the Supplementary Information of the Federal Register notice proposing these changes the following paragraph:

Part 60 currently requires DOE to carry out a performance confirmation program which is to continue until repository closure. Part 60 does not now require monitoring after repository closure because of the likelihood that post-closure monitoring of the underground facility would degrade repository performance. The Commission recognizes, however, that monitoring such parameters as regional groundwater flow characteristics may, in some cases, provide desirable information beyond that which would be obtained in the performance confirmation program. The proposed requirement for post-permanent closure monitoring requires that such monitoring be continued until termination of a license. The Commission intends that a repository license not be terminated until such time as the Commission is convinced that there is no significant additional information to be obtained from such monitoring which would be material to a finding of reasonable assurance that long-term repository performance would be in accordance with the established performance objectives.

3.a. EPA Assurance Requirement:

(c) Disposal sites shall be designated by the most permanent markers, records, and other passive institutional controls practicable to indicate the dangers of the wastes and their location.

b. Discussion:

No revisions to Part 60 are needed. §60.21(c)(8), 60.51(a)(2), and 60.121 contain equivalent provisions.

4.a. EPA Assurance Requirement:

(d) Disposal systems shall use several different types of barriers to isolate the wastes from the environment. Both engineered and natural barriers shall be included.

b. Discussion:

The staff considers that Part 60 already requires use of both engineered and natural barriers. Nevertheless, in order to avoid any possible confusion regarding the provisions of §60.113(b), the staff proposes to add additional clarifying language to §60.113.

c. Proposed Changes to Part 60:

Add a new ¶ (d) to §60.113 as follows:

(d) Notwithstanding the provisions of (b) above, the geologic repository shall incorporate a system of multiple barriers, both engineered and natural.

In the Supplementary Information of the Federal Register notice proposing these changes include the following:

Questions might arise regarding the types of engineered or natural materials or structures which would be considered to constitute barriers. The Commission notes that §60.2 now contains the definition: "'Barrier' means any material or structure that prevents or substantially delays movement of water or radionuclides." Thus, the Commission considers that the new paragraph to be added to §60.113 will confirm the Commission's commitment to a multiple barrier approach as contemplated by Section 121(b)(1)(B) of the Nuclear Waste Policy Act.

5.a. EPA Assurance Requirement:

(e) Places where there has been mining for resources, or where there is a reasonable expectation of exploration for scarce or easily accessible resources, or where there is a significant concentration of any material that is not widely available from other sources, should be avoided in selecting disposal sites. Resources to be considered shall include minerals, petroleum or natural gas, valuable geologic formations, and ground waters that are either irreplaceable because there is no reasonable alternative source of drinking water available for substantial populations or that are vital to the preservation of unique and sensitive ecosystems. Such places shall not be used for disposal of the wastes covered by this Part unless the favorable characteristics of such places compensate for their greater likelihood of being disturbed in the future.

b. Discussion:

Part 60 contains provisions equivalent to this assurance requirement in §60.122(c)(17), (18), and (19). Part 60 does not, however, address "a significant concentration of any material that is not widely available from other sources."

It is possible that the economic value of materials could change in the future in a way which might attract future exploration or development detrimental to repository performance. The staff proposes to add an additional potentially adverse condition to Part 60 related to significant concentrations of material that is not widely available from other sources. As with the other potentially adverse conditions, the presence of such a condition would require an evaluation of the effect of the condition on repository performance as specified in §60.122(a)(2)(ii), but would not preclude selection of a site for repository construction. (It should be noted that DOE's siting guidelines contain an identical provision in 10 CFR 960.4-2-8-1.)

c. Proposed Changes to Part 60:

Add a new § (18) to §60.122(c) as follows:

(18) The presence of significant concentrations of any naturally-occurring material that is not widely available from other sources.

Renumber the current § (18) through (21) accordingly.

6.a. EPA Assurance Requirement:

(f) Disposal systems shall be selected so that removal of most of the wastes is not precluded for a reasonable period of time after disposal.

b. Discussion:

EPA's concept of "removal" is significantly different from "retrieval" in Part 60. EPA wants to preclude disposal concepts such as deep well injection for which it would be virtually impossible to remove or recover wastes regardless of the time and resources employed. For a mined geologic repository wastes could be located and recovered, albeit at great cost, even after repository closure. EPA therefore considers that a repository complies with this assurance requirement, and no revision to Part 60 is needed.

DEC 23 1985

MEMORANDUM FOR: R. F. Fraley
Executive Director
Advisory Committee on Reactor Safeguards

FROM: William J. Dircks
Executive Director for Operations

SUBJECT: RESPONSE TO ACRS COMMENTS ON EPA HLW STANDARDS (FOLLOW-UP
ITEMS FROM 306th and 307th ACRS MEETINGS)

In letters dated October 16 and November 14, 1985, David A. Ward transmitted to Chairman Palladino the comments of the ACRS regarding the high-level radioactive waste standards published by the Environmental Protection Agency (EPA) on September 19, 1985. As the NRC staff understands, these comments can be summarized as follows:

1. In comparison with other risks, the standards are unduly restrictive.
2. Because the standards are so restrictive, and because of the probabilistic nature of the standards, it will be very difficult, if not impossible, for the NRC to determine compliance with the standards in a licensing review for an actual repository.
3. The standards contain internal inconsistencies (e.g., the dose limits during repository operations are slightly different for licensed and unlicensed repositories) and the standards do not incorporate the latest ICRP recommendations regarding doses to individual organs.

Regarding the first item above, the ACRS has stated that the level of risk allowed by the EPA HLW standards is much lower than that allowed by other standards for radiological and non-radiological hazards. However, the staff has found that under certain reasonable scenarios and assumptions (e.g., the size of the population at risk) the EPA standards can be shown to be comparable to other standards now in place for other nuclear activities, as we discussed in our presentation to the ACRS on November 8, 1985. Since the risks allowed by the EPA standards can be viewed in such widely different ways, the staff has concentrated on the achievability of the standards rather than on comparisons with the risks allowed by other standards.

The ACRS is concerned that the low level of allowable risk, combined with the probabilistic nature of the standards, will make the standards difficult to implement in an actual repository licensing review. Previous NRC contractor

studies (documented in NUREG/CR-3235) demonstrated (1) that analytical techniques exist, or are under development, to evaluate potential releases from a geologic repository, and (2) that repository sites can likely be found for which repository performance can be demonstrated to be in compliance with the EPA HLW standards. The NRC staff will further develop its views regarding its ability to implement the EPA standards in the rulemaking package currently being prepared to incorporate the EPA standards into Part 60.

Regarding inconsistency within the standards, the NRC staff recognizes that EPA has, for pragmatic reasons, chosen to maintain consistency with other existing EPA standards including the uranium fuel cycle and drinking water standards. This has resulted in internal inconsistencies within the EPA HLW standards which, while not desirable, do not appear to endanger public health and safety nor to pose inordinate costs or difficulties for implementation of the standards by the NRC. In the NRC staff's view, a general overhaul of EPA's radiation protection standards would be needed to adopt the revised ICRP recommendations and to promote consistency between (and within) standards. The NRC staff would support such an initiative by the EPA.

The ACRS also recommended: (1) acceleration of NRC staff efforts to develop analytical methods for evaluating repository performance and (2) that a consensus be sought, possibly through rulemakings, on these methods as they are developed. With respect to the first recommendation, we note that, in a meeting on October 24, 1985, we briefed the ACRS Subcommittee on Waste Management on our HLW program plan and described how we have allocated resources to each major program element. As we described in this briefing, a major program element is development of licensing assessment methodologies; we believe this represents an aggressive effort. We will continue to seek ways to accelerate licensing assessment methodology development and still meet other requirements of the Nuclear Waste Policy Act and Commission priorities. As stated in our October program briefing, we look forward to receiving Subcommittee comment on our program strategies and specific feedback on the tradeoffs we have made among program elements in allocating resources and setting schedules. With respect to the second recommendation, the staff agrees that rulemaking may prove to be an appropriate means of developing consensus regarding certain aspects of the staff's analytical methods. We note that the staff has an on-going effort to identify licensing

issues and to seek early resolution through such means as public review and comment on technical positions developed by the staff. We will continue to pursue early resolution of licensing issues using technical positions and, as appropriate, rulemakings.

As suggested by the staff requirements memorandum for SECY-85-272, the staff would appreciate an opportunity to discuss the staff's proposed conforming amendments relating to proposed implementation procedures with the ACRS in the near future.

(Signed) Jack W. Roe

William J. Dircks
Executive Director for Operations

*See previous concurrence

EDO
WJDircks
12/ /85

C	:WMRP	:WMRP	:WMRP	:DWM	:DWM	:NMSS	:NMSS
ME	:DFehring*	:RBoyle*	:HJMiller*	:MJBell*	:RBrowning*	:DMAusshardt*	:JGDavis
TE	:12/02/85	:12/03/85	:12/03/85	:12/ /85	:12/ /85	:12/ /85	:12/ /85



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

Bernero for Appropriate Action
(EDO Signature)

cys: Stello
Taylor
Thompson
Blaha
Murley, NRR
Beckjord, RES
Jordan, AEOD
Scinto, OGC
Central Files

May 3, 1989

The Honorable Lando W. Zech, Jr.
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Chairman Zech:

SUBJECT: PROPOSED WASTE CONFIDENCE DECISION BY THE WASTE CONFIDENCE
REVIEW GROUP

During its ninth meeting, April 26-28, 1989, the Advisory Committee on Nuclear Waste (ACNW) met with members of the NRC Staff to discuss the preliminary draft of the proposed Waste Confidence Decision (see reference) by the Waste Confidence Review Group. This matter was also a subject of discussion during a meeting held on April 19, 1989 by an ACNW Working Group.

On August 31, 1984, the NRC issued a final decision on what has come to be known as its "Waste Confidence Proceeding." The current review is an update of that assessment, and a significant feature in this latest review is the incorporation of the changes brought about by the Nuclear Waste Policy Amendments Act of December 1987.

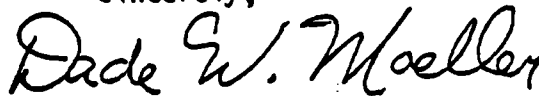
On the basis of our discussions on this matter, we offer the following comments:

1. We believe the present report appears to be technically sound, and in this assessment, we endorse both the expanded application of the generic approach to the majority of nuclear power plants and the incorporation into the proceedings of a more realistic timetable for the availability of a licensed repository and an extended time interval for the storage of spent fuel.
2. We continue to have concerns about the ability of the NRC staff to confirm that the repository complies with the probabilistic standards developed by the U.S. Environmental Protection Agency. The explanations given in the proposed Waste Confidence Decision on how this is to be accomplished do not illuminate the process nor do they provide convincing arguments that it can be accomplished.

May 3, 1989

The report also needs organizational and editorial changes to enhance the ease with which it can be read and assimilated.

Sincerely,

A handwritten signature in cursive script that reads "Dade W. Moeller".

Dade W. Moeller
Chairman

Reference:

Memorandum dated April 17, 1989 from Robert M. Bernero, Director, Nuclear Material Safety and Safeguards, to Dade Moeller, Chairman, ACNW, transmitting Preliminary Draft of Waste Confidence Review Group Proposed Waste Confidence Decision (PREDECISIONAL)



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

July 3, 1989

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

Dear Chairman Carr:

SUBJECT: ACNW REVIEW OF NRC COMMENTS ON DOE SITE CHARACTERIZATION PLAN

During its twelfth meeting, June 28-30, 1989, the Advisory Committee on Nuclear Waste (ACNW) completed its review of the Site Characterization Analysis (SCA) being prepared by the NRC staff on the Site Characterization Plan (SCP) developed by the U.S. Department of Energy (DOE) for the proposed high-level waste (HLW) repository at Yucca Mountain. During this meeting, the Committee had the benefit of discussions with staff members from the NRC and DOE. This matter was also a subject for discussion during the sixth through eleventh meetings of the ACNW, as well as during an ACNW Working Group meeting on April 19, 1989. During the seventh meeting, February 21-23, 1989, we had discussions and interactions with representatives from the State of Nevada's Nuclear Waste Project Office. The Committee also had the benefit of the documents referenced.

In approaching this task, the Committee assigned the responsibility for reviewing specific subject categories in the SCA to individual ACNW consultants. These consultants met with members of the NRC staff for in-depth discussions and then served as leaders for reviews of the assigned subject categories during the eleventh and twelfth meetings of the Committee. Throughout our reviews, we have interacted with the NRC staff on a continuing basis, and many of our comments are the culmination of this iterative process.

As a result of our review, we have reached certain conclusions and want to offer specific recommendations concerning the SCP and/or the SCA. Our more significant comments deal with:

- the absence in the SCP of statements addressing the systematic and early identification and evaluation of potentially disqualifying features at the Yucca Mountain Site;
- the apparent lack of sufficient attention to the limitations and uncertainties in the Yucca Mountain data bases, and the associated difficulties in demonstrating that the repository will comply with the Environmental Protection Agency (EPA) standard (40 CFR Part 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes"); and

- Delays by DOE in implementing satisfactory quality assurance (QA) programs.

Our specific comments follow:

1. Although the SCP is an action plan for site characterization, we believe that a much stronger focus should be placed on early detection of potentially disqualifying features. The SCA is not sufficiently emphatic in its critique of the lack of such a focus. We believe that the SCA should point out the need in the SCP for an integrated section of the plan that explicitly addresses the activities leading to an evaluation of characteristics of the site directly related to disqualifying features (e.g., groundwater travel time) as stated in the regulations.
2. Uncertainties and limitations in the data used to justify conclusions will be the center of most contentions. Since the ability to resolve these uncertainties experimentally may well be beyond the practicality of the program, planning for their management is required. We recommend that the NRC staff strengthen its treatment of this topic in the SCA.

As was briefly discussed with the Commission during our meeting on April 27, 1989, we believe that the NRC staff should encourage DOE to develop a scoping Level 2 (Release Estimate) probabilistic risk assessment (PRA) for the proposed Yucca Mountain repository. Such a PRA should be useful in defining those parameters that are critical to the adequate performance of the proposed facility, and would help to set priorities for the accompanying investigations.

Subsequent to our discussions with the Commission, we were pleased to learn that DOE plans to begin conducting in 1990 or 1991 probabilistic system performance assessments for the proposed repository. We recommend that the NRC allocate resources sufficient to develop the expertise necessary to conduct an adequate, independent evaluation of the probabilistic system performance assessments that will be submitted by DOE as part of its application for a construction permit for the proposed repository.

The Committee was told by the NRC staff (and this view was supported by one of our consultants) that the DOE staff may have considerable difficulties in generating a complementary cumulative distribution function (CCDF) for the site and, if this is the case, they may not be able to demonstrate the required compliance with the EPA standard. This difficulty in demonstrating compliance could represent a disqualifying feature for the proposed repository location. We urge that this concern be addressed in the SCA.

3. We believe that the NRC staff has been extremely tolerant of the delays by DOE in establishing a satisfactory QA process by the Office of Civilian Radioactive Waste Management (OCRWM) for

the Yucca Mountain project. Although one of the Objections in the SCA being prepared by the NRC staff addresses this matter, we believe that this troublesome issue should be promptly resolved since continued absence of approvable QA systems will increase the burden on the participants in licensing processes when qualification of data is at issue.

4. Additional comments on selected topics include:

- a. Because the Calico Hills formation is intended to serve as a barrier between the radioactive waste and the underlying saturated zone, some form of compromise must be reached between maintaining this formation as a barrier and drilling into or exploring within it to determine its critical characteristics. The NRC staff should include in the SCA a recommendation that DOE be definitive on how they will obtain the data necessary to determine the characteristics of the Calico Hills formation.
- b. Because of the significance of the waste package in the containment of the associated radionuclides, it is important that decisions be made soon on the materials to be used in fabricating the waste packages and the manner in which they are to be sealed. Such information is essential in considering possible interactions between the packages and the repository materials with which they will be in contact. Consideration of these interactions will require determination of the specific chemical composition of the repository water, and the SCA should reflect this concern.
- c. One of the key parameters in determining the adequacy of the proposed site is the rate of groundwater flow. In this regard, the NRC staff should emphasize in the SCA the need to obtain information on whether matrix or fracture flow (or a combination of the two) will govern water movement.
- d. Current concerns with the location of the Exploratory Shaft Facility (ESF) pertain to its distance from faults and the appropriateness of the samples it will yield in providing data that are representative of the proposed repository location. We believe the SCA should emphasize the need for the application of a comprehensive range of techniques (e.g., subsurface mapping, geophysical surveys) to the study of this problem.

In the development of the Title I design for the ESF, the DOE staff was supposed to have provided a conceptual approach for construction of the facility. Reviews by the NRC staff (and ACNW consultants) indicate that this was not the case. The staff should ensure that the SCA states that before DOE proceeds further with the Title II design, which will provide

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additional details on the proposed ESF, DOE should promptly address the errors and deficiencies in the Title I design.

- e. We believe that consideration should be given to extending the geoscience (hydrology, geology, geophysics) investigations to a distance sufficient to provide data on conditions within the region surrounding the site. Some of the existing investigations appear to be too limited in their geographical coverage. For example, because of the importance of the potential of volcanism, such an extension would appear mandatory to ensure that these studies have the potential for uncovering any disqualifying features.
- f. A range of alternative conceptual models will be used in conducting performance assessments for the repository. In our opinion, there are two problems associated with these models, namely, they are incomplete and they are not integrated. The SCP should be constructed so as to provide data that identifies the correct model, rather than merely confirming the preferred model. Since modeling is essential in determining the performance of the proposed repository and for uncovering potential disqualifying features, these deficiencies must be corrected. Such determinations should be scheduled as early as possible in the site characterization process, and this should be reflected in the SCA.
- g. The potential for natural resources in the area and the scenarios that are to be considered relative to possible human intrusion (some of which are related to exploration for such resources) need to be given more attention. A much more thorough assessment of potential mineral resources, including petroleum, should be required in the SCP, and the SCA should indicate this need.

With respect to human intrusion, the Committee notes that guidance on this matter is provided in EPA standard 40 CFR Part 191. We support the NRC staff recommendation that the DOE staff should consider this guidance in the development of the CCDF for the site.

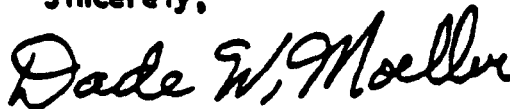
- h. The NRC staff has apparently accepted the lack of details in the SCP on test procedures and schedules for various site analyses since these are to be provided in the Study Plans being prepared by DOE. This places an increased burden for reviewing the Study Plans on the NRC staff. We recommend that the NRC staff note this problem in the SCA and that enhanced details of the characterization program be included in the periodic progress reports that will be submitted by DOE to supplement the SCP.

July 3, 1989

5. The SCA methodology and its basis are sharply focused on the individual sections of the SCP. Nevertheless, it might be useful if the NRC staff would produce an addendum that, among other items, contains those comments related to global or generic matters. For example, we believe that a useful comment in such a section would be to urge DOE to recognize that the licensing process and any decisional activities connected with it are adversarial. We also believe that this characteristic of the licensing proceedings should encourage DOE to ensure that its technical arguments are as much beyond challenge by responsible scientists as reasonable. The context of the SCA should be responsive to this need.

We trust these comments will be helpful in the development of the Site Characterization Analysis. In closing, we want to acknowledge and thank staff members of both the NRC and DOE for their cooperation and support during our review. All the people with whom we have interacted have been helpful and responsive to our questions.

Sincerely,



Dade W. Moeller
Chairman

References:

1. U. S. Department of Energy, DOE/RW-0199, "Site Characterization Plan - Yucca Mountain Site," December 1988
2. U. S. Nuclear Regulatory Commission draft Site Characterization Analysis, Sections 1, 2, and 3, received June 27, 1989 (Predecisional)
3. U. S. Department of Energy, DOE/RW-0206, "Site Characterization Plan - Public Handbook, Yucca Mountain, Nevada," January 1989
4. U. S. Department of Energy, DOE/RW-198, "Site Characterization Plan Overview, Yucca Mountain Site," December 1988
5. U. S. Nuclear Regulatory Commission, "Administrative Plan and Procedures for NRC Staff Review of DOE's Consultation Draft Site Characterization Plan," December 18, 1987
6. U. S. Nuclear Regulatory Commission, "Draft Technical Review Plan for NRC Staff Review of DOE's Site Characterization Plans," December 18, 1987
7. U. S. Nuclear Regulatory Commission, "Review Plan for NRC Staff Review of DOE's Site Characterization Plan," December 12, 1988
8. U. S. Nuclear Regulatory Commission, Regulatory Guide 4.17, "Standard Format and Content of Site Characterization Plans for High-Level-Waste Geologic Repositories," March 1987
9. Ross, B., Disposal Safety Incorporated, Prepared for Sandia National Laboratories, SAND 85-7117, "A First Survey of Disruption Scenarios for a High-Level-Waste Repository at Yucca Mountain, Nevada," December 1987

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10. Letter dated June 1, 1989 from John J. Kearney, Edison Electric Institute, to C. P. Gertz, Yucca Mountain Project Office, DOE, regarding DOE Site Characterization Plan
11. Letter dated May 3, 1989 from R. Loux, Nevada Agency for Nuclear Projects, Waste Project Affairs, to C. Gertz, , DOE Yucca Mountain Project Office, Subject: State of Nevada Preliminary Comments on the Site Characterization Plan for the Yucca Mountain Candidate High-Level Nuclear Waste Repository Site