

OFFICIAL TRANSCRIPT OF PROCEEDINGS

Agency: Nuclear Regulatory Commission
Advisory Committee on Nuclear Waste

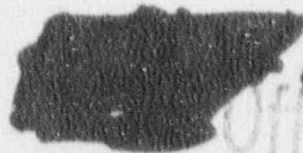
Title: 26th ACNW General Meeting

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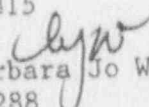
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Thanks! Barbara Jo White
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PUBLIC NOTICE BY THE
UNITED STATES NUCLEAR REGULATORY COMMISSION'S
ADVISORY COMMITTEE ON NUCLEAR WASTE

DATE: December 12, 1990

The contents of this transcript of the
proceedings of the United States Nuclear Regulatory
Commission's Advisory Committee on Nuclear Waste,
(date) December 12, 1990,
as reported herein, are a record of the discussions recorded at
the meeting held on the above date.

This transcript has not been reviewed, corrected
or edited, and it may contain inaccuracies.

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON NUCLEAR WASTE
26TH ACNW GENERAL MEETING

Nuclear Regulatory Commission
Room P-110
7920 Norfolk Avenue
Bethesda, Maryland

Wednesday, December 12, 1990

The above-entitled proceedings commenced at 8:30
o'clock a.m., pursuant to notice, Dade W. Moeller, Committee
Chairman, presiding.

PRESENT FOR THE ACNW SUBCOMMITTEE:

- Martin Steindler, Vice Chairman
- William J. Hinze, Member
- Paul W. Pomeroy, Consultant
- Eugene E. Voiland, Consultant
- Donald Orth, Consultant
- David Okrent, Consultant
- Charlotte Abrams, Designated Federal Official

1 PARTICIPANTS:

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R. Fraley

H. Schofer

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R. Bernero

A. Eiss

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S. Copeland

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P R O C E E D I N G S

[8:30 a.m.]

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3 MR. MOELLER: The meeting will now come to order.
4 This is the first day of the 26th meeting of the Advisory
5 Committee on Nuclear Waste. I am Dade Moeller, Chairman of
6 the Committee. The other ACNW members present are Martin
7 Steindler, William Hinze and Paul Pomeroy. We have a team
8 of consultants with us consisting of Donald Orth, Gene
9 Voiland and David Okrent.

10 During today's meeting the Committee will, number
11 one, discuss conforming Title 10 Part 60 of the Code of
12 Federal Regulations, the High Level Waste Repository
13 Subsystem Performance Requirements, consider conformance of
14 those with the EPA High Level Waste Standards. We will
15 discuss anticipated Committee activities. Third, we will
16 discuss and begin preparation for an ACNW presentation at
17 the Waste Management 1991 Symposium in Tucson, Arizona in
18 February. We will be briefed on recent reports from ACNW
19 working groups, and we will prepare for our meeting with the
20 NRC Commissioners tomorrow. We will also be discussing
21 several draft reports for letters that the Committee is
22 considering either issuing or beginning to compile or
23 prepare at this meeting.

24 The meeting is being conducted in accordance with
25 the provisions of the Federal Advisory Committee Act and the

1 Government in the Sunshine Act. Richard Major is the
2 designated Federal Official for the initial portion of the
3 meeting. Charlotte Abrams is filling that position at the
4 moment.

5 The rules for participation in today's meeting
6 have been announced as part of the notice that was published
7 in the Federal Register. We have received no written
8 statements nor have we received any requests from members of
9 the public to make oral statements at today's meeting.
10 However, as is our policy if, at any time, a member of the
11 public or representative of another Federal organization or
12 anyone who is present here has something that he believes is
13 germane to the subject being discussed and they want to make
14 a point, all they have to do is check with us and we will
15 provide the time and give them an opportunity to express
16 their thoughts.

17 A transcript of portions of the meeting are being
18 kept, and it is requested that each speaker use one of the
19 microphones, identify yourself, and speak with sufficient
20 clarity and volume so that you can be readily heard.

21 Before proceeding, I have a few brief remarks of
22 possible current interest. We have a long list. I am not
23 going to go over all of them, but let me say to the members
24 of the Committee and Consultants that we have distributed an
25 item which is called Items of Potential Interest to the

1 ACNW. I will go over a few of those. Also, in your
2 notebook, you have several pages -- one page of additional
3 items of possible interest.

4 In terms of those on the list that is not in the
5 notebook -- the list that was distributed to you -- when the
6 Committee talks about future meeting items, I still call
7 your attention to the subject of uranium and thorium mill
8 tailings and their disposal. Georgio Nunolli has sent us a
9 number of items recently on this, and you may want to look
10 at those or consider them.

11 I notice also that the Licensing Support System
12 Advisory Review Panel -- this is number three on the list --
13 has reviewed and commented on the draft regulatory guide,
14 Topical Guidelines for the Licensing Support System. It may
15 be that we want to look at that. I really don't know, but I
16 call it to your attention. Item four on page two, Sandia,
17 issued a report. I have not read it, but it is on --
18 apparently they are working on a waste minimization project.
19 We can talk about disposal of waste all day, but the heart
20 of the problem is the generation of the waste in the first
21 place. It may be that we, at some time, may want to look at
22 that and have a briefing on it.

23 In a similar light under Item 4, there was a
24 letter to the editor of Science a week or so ago, once more
25 on transmutation of waste. If we could help in any way in

1 clarifying that subject -- I know we have talked about it,
2 but keep it in the back of your mind as something we may
3 want to look at.

4 I notice that the U.S. and USSR have signed on
5 September 18th a pack on rad waste. It would be interesting
6 --again, each of these are future meeting potential items
7 and we need to talk about them, but it would be interesting
8 to hear someone tell us what is the agreement and what is
9 going to be accomplished and so forth. Item 6 is one that I
10 really personally believe that we have got to put on our
11 agenda, and that is the impact of Title X Part 20, the
12 revised document on waste management activities.

13 Item 7 I call your attention to, because that
14 report has several -- it's a French report - it has several
15 chapters on human intrusion. It is for Saliferous
16 formation.

17 MR. HINZE: Can you define it, even if you can't
18 spell it?

19 MR. MOELLER: No. The item 9 I will be calling to
20 your attention later. Brookhaven issues an annual report --
21 it's obviously the NRC issues it and Brookhaven compiles it
22 for them -- on "radioactive materials release from nuclear
23 power plants." It is issued as NUREG CR-2907. The latest
24 volume is volume eight. I am not sure as I say that, but I
25 believe that's the latest volume.

1 Why I became interested in it, we were talking
2 about Carbon-14 so I thought I would open up this detailed
3 report and find out how much Carbon-14 is airborne released
4 from nuclear power plants. Well, there is none. Yet, there
5 are other airborne releases in micro or pico curie level but
6 Carbon-14 isn't released. I called the NRC staff and said
7 why, and they said the report only includes what they
8 monitor or what they have the capability of measuring.

9 I think personally sitting as a member of the
10 public that that's misleading. Maybe it says it in the
11 forward but I didn't see it. Some plants will list krypton
12 85 and others won't. Some will list Xenon 135 and others
13 won't. I would think that we would have a standard set of
14 guides on what the release is. This is important to us
15 because it lists the airborne releases, the liquid releases
16 and the solid waste releases. Like in the BWR's they list
17 no krypton 85 for the newest BWR's because they have hold up
18 tanks, retention tanks and don't let it out.

19 It still exists, so it ought to be recorded
20 someplace. As I say, it's a little pet item of mine, but I
21 found the report not as useful as I thought it would be.

22 In the A,B, and C until Item 9, when we transfer
23 from Zywrite to Wordperfect it goes wild. The MDSU means
24 that in the MDNM you delete -- it is just Carbon-14. I
25 would raise the 14, and the computer goes wild. Item 10 --

1 Bob Bernero is here so he can help us -- EPA produced this
2 pamphlet of which they gave us a copy of for yesterday's
3 meeting on mixed waste, this pamphlet that they said send it
4 out to all the states. It looks like Readers Digest.

5 As I understand it, that was produced without any
6 consultation with the NRC, and they gave you -- am I wrong?

7 MR. BERNERO: I think you are mistaken in that.
8 Could I amplify a little bit?

9 MR. MOELLER: Yes, please.

10 MR. BERNERO: There are two pieces of material
11 related to mixed waste. One is that pamphlet, and as I
12 recall, we did consult with that. That is a very nice
13 pamphlet, a good guide through a difficult law. There is
14 also a body of guidance that was produced on what a lot of
15 people call the Land Ban or storage requirements. It's
16 illegal to store mixed waste if you don't have a disposal,
17 very strict time limits and so forth.

18 That guidance on what to do with stored mixed
19 waste was produced essentially without NRC consultation.
20 Right now both are sitting on my desk. I am trying to
21 communicate with EPA. The only way they can make sense to
22 NRC licensees is to go out together. The guidance on
23 storage is a hopeless hodge podge of acronyms, and you need
24 the users guide to RCRA -- which that little booklet is.
25 Thank God the Atomic Energy Act is better than that.

1 MR. MOELLER: That helps, because I read that you
2 had not yet distributed it and I didn't understand. I was
3 mixed up.

4 MR. BERNERO: They need coupling.

5 MR. MOELLER: They need coupling, okay. Item 11,
6 which I am sure Charlotte must have sent to us, John Linehan
7 has summarized the status of 14 DOE Study Plans, the staff's
8 review of it. I call that to your attention. Jumping to
9 page five, item 19 I again have not had time to read it.
10 EPRI now has issued a report on the soil to plant transfer
11 of Carbon-14, and it may have something of interest to us in
12 terms of our deliberations on that.

13 Item 20, we visited West Valley a year or two ago.
14 They are continuing to work there, and there have been a
15 number of interesting recent developments. We may want to
16 come back to that sometime. Charlotte attended -- Item 21 -
17 - attended the NWTRB QA panel meeting, and she has provided
18 us with a summary on that. I simply wanted to mention it.

19 Item, this long term use of encapsulated and
20 storage facilities at commercial irradiator -- we may need
21 to discuss that. In fact, I think we do. Apparently the
22 ACRS has an interest or may have an interest in that. So,
23 we need to decide whether we cover it or if they do. The
24 same thing is true in terms of enrichment facilities, simply
25 divvying it up or decided who is proper to handle it.

1 MR. STEINDLER: Use the microphone.

2 MR. OKRENT: My comment would come better after
3 23.

4 MR. MOELLER: All right. Item 23, we wanted to
5 congratulate Martin Steindler, the 1990 winner of the Robert
6 E. Wilson Award of the American Institute of Chemical
7 Engineers. The award is in honor of his outstanding
8 contributions to chemical engineering and his achievements
9 in the nuclear industry. We wanted to recognize Charlotte
10 Abrams. The NRC announced and listed her among the awardee
11 or whatever it is for her work with the public schools in
12 the local area. I am sure that it wasn't alphabetical, but
13 she was the first one listed.

14 [Laughter.]

15 MR. MOELLER: Gail Marcus received a certificate
16 of appreciation from the NRC. You should know that Regis
17 Boyle has been appointed TA to Commissioner Remick for all
18 NMSS activities including rad waste. In the notebook, the
19 ICRB, you recognize I am sure that while they will be
20 issuing I guess what they call their 1990 recommendations --
21 I guess they will come out in 1991. It will probably
22 undoubtedly reduce the long term accumulated dose to a rad
23 worker to an average of about 20 milli sieverts per year
24 averaged over five years.

25 Another item, the NRC is considering a measure to

1 give the states more time to meet the low level waste
2 obligations. Kim Nukler has indicated that the next
3 generation of low level rad waste disposal facilities will
4 employ new technologies, receive less waste and charge
5 significantly more than the Barwell facility.

6 MR. BERNERO: Dr. Moeller, if you could please go
7 back to that item of interest about NRC considering more
8 time to implement low level waste. Unfortunately, at least
9 two publications have described it as such, and nothing
10 could be farther from the truth.

11 MR. MOELLER: All right. Clarify.

12 MR. BERNERO: The Low Level Waste Act has a
13 schedule and it's a very intricate schedule. Individual
14 milestones for the states to meet as they proceed toward
15 full implementation. A collateral issue that comes up is
16 the licensing or authorization of extended storage if you
17 are not meeting the schedule. There is a very difficult
18 position for the NRC, in that if a state is not on schedule
19 and the state says therefore I am going to establish a
20 holding facility or storage facility it would be licensed
21 for five years or ten years or something like that, is that
22 not an indirect way to frustrate implementation of the Act.

23 The Commission -- we had a meeting on it not long
24 ago. I don't remember the exact date but in the past month.
25 The Commission is wrestling with the issue as well. It is

1 not a matter of us authorizing the states to extend the
2 milestones of the law, it is do our actions with respect to
3 storage, licensing and holding of low level waste, enable
4 them to get some wiggle room and miss schedules.

5 MR. MOELLER: Very good. Thank you. Let's go
6 back to David Okrent.

7 MR. OKRENT: This is an observation that is
8 probably out of place but let me say it anyway. If I try to
9 think back for more than 20 years it seems to me that the
10 ACRS used to have a problem in that its agenda was always
11 crowded. Many of the items were of interest but they didn't
12 always really have a vital need of ACRS opinion on them or
13 probing and so forth. It took a concerted effort which was
14 only partially successful to force time in the agenda when
15 the important topics of the day would be discussed.

16 Over the months of Committee --

17 MR. MOELLER: The reporter is having problems
18 hearing you.

19 MR. OKRENT: Well, she's not missing anything.

20 [Laughter.]

21 MR. OKRENT: I can't help getting the sensation
22 that ACNW might do well having some interspection in looking
23 both at its full Committee and what it does in terms of
24 working groups to see if it is -- in the first place
25 identify what are the key issues for us to tackle, and that

1 it is putting the time available for this with the highest
2 priority and other things sitting as they can.

3 MR. MOELLER: That is a good suggestion, and it
4 couldn't be more appropriate. We have, and I think it's
5 been distributed to you, a memorandum from Chairman Carr in
6 which he has asked us -- indeed we will address it at this
7 meeting -- he has asked us to identify the three top
8 priority items that we will be working on in the next year
9 or so. We will be doing that.

10 Let's move on with our agenda, and I will turn it
11 over to Martin Steindler. Martin, would you introduce it.

12 MR. STEINDLER: The topic of discussion is raised
13 by a question that has been posed to us by Commissioner
14 Curtis who is correctly looking for some kind of a
15 connection between the NRC's regulations and the EPA
16 regulations. Specifically, I think he is concerned about
17 the subsystem requirements that exist in the NRC
18 regulations.

19 In the ideal world if we were designing from
20 scratch from a uniform base, the rules and regulations and
21 policies that governed disposal of a material such as high
22 level waste, we probably would not have done it the way it
23 turned out. One might have assigned to the EPA a general
24 societal risk-related activity for regulation of not only
25 high level nuclear waste but as well as the other things

1 that they are charged with and then assign to the NRC
2 specifics.

3 The NRC has been assigned some specifics, but the
4 requirements that have been developed are somewhat governed
5 by the general notion that if one lock is good three locks
6 are better. The question then is, are these sub-
7 requirements consistent with each other and across the
8 agencies are they useful, and can they be demonstrably shown
9 to be in the same ballpark in terms of risk or assurance
10 that is required for an in depth health and safety issue or
11 analysis of waste disposal.

12 It isn't very obvious that we can arrive at a
13 quantitative determination for an answer to Mr. Curtis'
14 question, but at least we can open the discussion on the
15 subject. I guess Bob is going to be the lead preacher in
16 this exercise.

17 MR. BERNERO: Well, I would like to beg off of
18 being the lead preacher, because the cat almost has my
19 tongue right now. Dan Fehringer is going to lead the
20 discussion with a presentation, and I welcome comments and
21 interjection as we go along.

22 MR. OKRENT: Is it possible that --

23 MR. STEINDLER: We cannot hear you.

24 MR. MOELLER: Is that microphone working?

25 MR. OKRENT: It is possible that there are a range

1 of ways in which one can look at some set of NRC regulations
2 -- I am not trying to argue about the specific wording here
3 -- that can play some role in the overall -- I was going to
4 say mishigash if those who understand the word -- in the
5 overall complexity of this waste hearing.

6 The issue of do they in fact serve to fulfill the
7 EPA standard or don't they maybe is not the context in which
8 one might look at these. Let me just put it that way.

9 MR. BERNERO: Let me speak to that. At the time
10 the standards began development back in the mid-1970's I
11 would call it, there was a very wide range of options for
12 EPA to follow and NRC to follow. There is still a wide
13 range of options today. The EPA remand doesn't necessarily
14 constrain EPA to the essential formula they have now, and
15 NRC to the essential formula we have now. With the passage
16 of time and the establishment of shall I call it certain
17 standard precedent of the form of the standard, and
18 recognizing the fact that only part of it was remanded I
19 think the range of options may not be as wide today from a
20 practical point of view, but intellectually it is still
21 there.

22 It is not necessarily are these three subsystem
23 performance criteria there alone, the EPA standard alone or
24 both together. That is not necessarily the constraint. I
25 would say though as a practical matter, if EPA did what I

1 rhetorically suggested a couple of months ago just say four
2 millirem to any individual anywhere ever is the standard and
3 then walk out of the room, that was an option in 1975. I
4 don't think it's a practical option today.

5 MR. FEHRINGER: As Dr. Steindler noted,
6 Commissioner Curtis has expressed an interest in the
7 subsystem performance objectives in Part 60. They represent
8 one of the most substantive parts of that regulation, and
9 he's not alone in his interest. It has been a subject of
10 considerable controversy over the years while they were
11 being developed, and since then there has been continual
12 questioning of those objectives.

13 [Slide.]

14 Today I would like to review the history of how
15 the subsystem objectives were developed, what the intent was
16 in formulating them the way they are, and then give some
17 ideas on how we will be re-examining those objectives as we
18 pursue our conforming amendments to adopt the EPA standards.

19 [Slide.]

20 In about 1978 there was a basic regulatory
21 philosophy somewhat different than that that ultimately
22 shaped Part 60. The basic philosophy at that time was that
23 regulations should match the design of a repository. It is
24 not an unreasonable philosophy; in fact, it's the one that
25 seems to be pursued in much of the rest of the world,

1 particular in Europe where the regulatory and developer
2 kind of jointly negotiate the design and the safety criteria
3 of a facility and the regulations serve to codify the
4 agreement that is reached and allow other parties to have an
5 input to comment on that agreement.

6 At the time that was the philosophy that we were
7 working under also. Also, particularly important, in the
8 late 1970's we thought that spent fuel would be reprocessed
9 so that uranium and plutonium would be separated for reuse
10 in the fuel cycle and possibly other actinide might also be
11 separated. That led us to look at disposal of high level
12 waste as a 1,000 year problem. We thought 1,000 years was a
13 long time then, but it was a less significant problem than
14 we now look at today with spent fuel.

15 At the time there were a number of studies that
16 showed that if the longer life constituents of spent fuel
17 were removed that radioactive decay would reduce the hazard
18 of the remaining high level waste to no greater than the
19 original uranium ore in a period of time probably somewhat
20 less than 1,000 years, and the 1,000 year limit seemed to
21 have a fair amount of technical acceptance within the
22 scientific community.

23 Design of a waste disposal system at that time
24 made no provision for containment by waste packages beyond a
25 very minimal period of time. The waste package was a

1 handling device primarily, allowing transportation of waste
2 from a reprocessing plant to a repository and then
3 transportation within the repository system for emplacement.
4 There were plans to process waste into a glass waste form,
5 but privately some people in the technical community were
6 even questioning the necessity of that step. It added to
7 the cost of a waste disposal system and some people were
8 arguing that a calcine or some other form of waste might be
9 acceptable.

10 In summary, in that late 1970's timeframe the
11 geologic barriers of the site were looked upon as providing
12 essentially all of the waste isolation, and it was thought
13 that they were more than adequate to do so.

14 MR. STEINDLER: Dan, you are outlining the state
15 in 1978. Is that the framework within which the NRC was
16 operating or do you attribute this framework essentially the
17 technical community at large? Is this a provincial
18 operation in two offices within the NRC. How big a group
19 are we talking about?

20 MR. FEHRINGER: This was the way that we at the
21 NRC viewed thinking within the technical community at large.

22 [Slide.]

23 In 1979 we had a change of management within the
24 NRC staff, and that brought a new regulatory philosophy to
25 the staff. That philosophy was that the design of a

1 repository should meet pre-established regulatory
2 objectives. Just a reversal of the previous philosophy.
3 The staff established a goal adopted from nuclear power
4 plant licensing of a multiple barriers that were fully
5 redundant. We thought that it was technically achievable to
6 have 1,000 years of containment within canisters. If the
7 canisters should fail we thought it would be achievable to
8 have 1,000 years of containment by the repository, what we
9 would now call the underground facilities. If both of those
10 engineered barriers failed, then we thought it was
11 achievable to require 1,000 years of containment by the
12 site.

13 The three way redundancy seemed to be a very
14 powerful argument for the acceptability of a disposal system
15 and as I say, it appeared to be technically achievable
16 without significant cost. That view was not widely shared
17 outside the NRC staff.

18 MR. BERNERO: Dan, could I interject for a moment?
19 I would like to make a comment having participated in some
20 of this that can help illuminate further the response to
21 your question, Dr. Steindler. When that sense of 1,000 year
22 reprocessing waste kind of disposal was there, there was
23 certainly unease about the residual transuranics and about
24 the fact that certainly there was going to have to be
25 something done with transuranic waste itself, the DOE

1 transuranic waste.

2 At the time that we went to this 1979 philosophy,
3 that's when Jack Martin became the division director of
4 waste management. There was at that time very strong
5 apprehension about the EPA trend toward a probabilistic
6 standard which went in some large measure to deal with the
7 unease about transuranics. In looking at this in 1979 can
8 see two ways to read the 1,000, 1,000, 1,000. For the 1,000
9 year waste the bulk of the material, it is fully redundant.
10 For the uneasy part of the problem, the transuranics, it
11 stands as either some sort of defense in depth of best
12 available harvest of margin. Or, it stands as a possible
13 deterministic surrogate for a probabilistic standard, and
14 that deterministic surrogate was a very strong motive at the
15 time to have an NRC regulation that would obviate
16 probabilistic calculations in the litigative environment.

17 MR. STEINDLER: Thank you.

18 MR. FEHRINGER: In 1980, we began to realize that
19 reprocessing spent fuel was not likely to occur. The nation
20 announced a policy of deferral of reprocessing, and that
21 combined with collapse of uranium prices made it look like
22 there was no longer an economic incentive for reprocessing.
23 We began to think that we would probably need to dispose of
24 spent fuel with all the uranium or plutonium and other
25 transuranic constituents present along with the fission

1 products.

2 [Slide.]

3 This led us to look at high level waste disposal
4 as at least a 10,000 year problem rather than the more
5 limited 1,000 year problem that we had been looking at
6 earlier. This made it difficult to retain the multiple
7 redundancy concept that we had been trying to adapt from
8 reactor licensing. That concept evolved into one of a
9 philosophy of multiple barriers with minimum performance
10 requirements, and in 1980 we issued an advance notice of
11 proposed rulemaking that had that philosophy articulated.

12 It retained redundancy for the first 1,000 years
13 exactly as the goals had been on the previous viewgraph;
14 1,000 year containment by canisters, 1,000 year containment
15 by underground facility, and a 1,000 year radionuclide
16 travel time from the repository to the environment. In
17 order to address the longer term potential for releases of
18 actinide, we added to that a provision that the annual
19 release rate from the underground facility after 1,000 years
20 should not exceed one part in 100,000 per year.

21 Significantly -- the last item on this viewgraph --
22 - there was no attempt to correlate these performance
23 objectives with an EPA standard. There were early working
24 drafts of EPA standards but we viewed these objectives as
25 being independent and complementary. These forced a

1 multiple barrier design and articulated the degree of
2 emphasis that we thought should be placed on each of the
3 barriers as a minimum independent of whatever overall system
4 performance requirements may be promulgated by EPA.

5 MR. STEINDLER: Let me make a couple of comments
6 and then maybe a question or two. On the surface that 1980
7 exercise sounds entirely arbitrary. It looks as though if I
8 take literally what you have up there, that you are
9 literally setting a set of criteria with no particular
10 intention or attention to correlate with standards. I
11 hardly believe that's an accurate statement, but that's what
12 it looks like.

13 Secondly, I am puzzled by your 10,000 year problem
14 description. By 1980 both people in the U.S. and elsewhere
15 had fairly carefully looked at not only spent fuel but the
16 mixture of fission products in the sundries with or without
17 iodine didn't make any difference, and looked at the issue
18 of hazard as a function of time and the famous curve which
19 all of us have seen ad nauseam had been published at least
20 by the Germans if not by everybody else by that time. Walt
21 Roger included.

22 Any reasonable look at those would drive you
23 fairly quickly to the conclusion that high level waste is
24 not a 10,000 year problem, at least from a technical basis.
25 Operating in units of multiples of ten as a good rationale

1 you don't address the issue at 2,500 years, you address the
2 issue at either 1,000 or 10,000. I am puzzled as to how you
3 got the 10,000 years.

4 MR. FEHRINGER: The point here is that disposal of
5 spent fuel involves disposal of much larger inventories of
6 long life materials. The 10,000 number came from EPA as
7 they were developing their standard at the time. I have the
8 plus because there were a number of comments suggesting
9 10,000 years was not long enough to be concerned about spent
10 fuel.

11 MR. STEINDLER: The EPA standard didn't address
12 10,000 years at that time.

13 MR. BERNERO: Let me interject. I think it's
14 becoming unduly complex because you are saying 10,000 years,
15 and it's 10,000 plus. The substance of the time of 1980 was
16 that you can't deal with it in the order of magnitude
17 10,000. It is going to be the next or the next order of
18 magnitude, ten or 100,000 years, and we haven't yet gotten
19 to the debate where EPA was saying is a calculation at
20 10,000 years sufficiently meaningful to represent behavior
21 over 50,000 or 100,000.

22 This is truly almost a no significant figure kind
23 of statement. It is clearly not the 1,000 years, it is much
24 beyond it. It is not exactly 10 -- we haven't yet gotten to
25 the theology of 10,000 years as a surrogate.

1 MR. CRTH: One small clarification which sort of
2 follows on with what Marty said. There is no relationship
3 between processing and not reprocessing, and 1,000 versus
4 10,000 except for the single element of plutonium which
5 accurately there is a lot more. With its half-life it
6 doesn't make any difference. There may be a lot more, but
7 all the rest of the fission products and everything else do
8 not change whether you reprocess or not.

9 MR. HINZE: If I may, please. Dan are you going
10 to explain to us where the 10,000 came from in the EPA
11 thinking?

12 MR. FEHRINGER: I hadn't planned to, but I can if
13 that's of interest to you. It is not a major point in the
14 presentation that I am giving. The point that I am trying
15 to say is that we were no longer to look at this as a
16 limited 1,000 year activity. Our repository must perform
17 well for periods beyond 1,000 years, and that destroyed the
18 notion of multiple redundant barriers for 1,000 years.

19 MR. HINZE: I have tried to search out that 10,000
20 year timeframe, and the only reason that I can come up with
21 deals with some information that the Science Board of the
22 EPA came up with; is that correct, dealing with glaciation
23 10,000 years ago. This seems like a logical number to have
24 looking at this 10,000 years ahead.

25 MR. FEHRINGER: EPA used two arguments to support

1 the 10,000 year cutoff. First, in their analysis of
2 hypothetical repositories they thought 10,000 years was long
3 enough to get a good test of whether a repository was
4 performing well or not. A lot of other people questioned
5 that, but that was an assertion they made.

6 MR. HINZE: Strictly qualitative.

7 MR. FEHRINGER: Yes. If you calculated
8 performance for 10,000 years you could distinguish good
9 repositories. The second reason was that it was a short
10 enough period of time that you could avoid some of the very
11 difficult uncertainties that start to crop up if you take
12 the next order of magnitude, multiple glacial cycles and
13 general geologic evolution.

14 MR. HINZE: Primarily climatological I think was
15 their basis, right.

16 MR. FEHRINGER: Right.

17 MR. HINZE: I think that's the origin of that
18 10,000 years.

19 MR. STEINDLER: Their statement in the Federal
20 Register under the preliminary considerations that preceded
21 the actual announcement of their standards indicated that
22 they looked at the range of short versus long and they
23 elected to pick 10,000 years because they couldn't see -- if
24 I remember it right and I think it's correct -- they
25 couldn't see as producing any useful hard data for times

1 longer than about this period. For times shorter than that
2 period as Dan correctly said, they weren't so sure that you
3 could get the kind of assurances of performance -- of long
4 term performance that they thought was necessary.

5 It is, obviously, a compromise in the logarithmic
6 scale.

7 MR. FEHRINGER: Before I continue, let me respond
8 to the first remark that Dr. Steindler had. He found it
9 hard to believe that we would suggest performance objectives
10 of this type without trying to correlate them with the EPA
11 standard, and a lot of other people found that hard to
12 believe also. That is historically correct. There is no
13 attempt to link these with EPA's standard as it was
14 developing at the time.

15 We viewed these as being completely independent
16 criteria that articulated the Commission's philosophy on how
17 a repository should be designed and constructed. That
18 certainly set the stage for the controversy that has
19 continued until this date on the subsystem objectives.

20 MR. BERNERO: I would add that certainly nested in
21 the minds of some of the NRC -- and I am one of them --
22 there was an expectation that we were going to ultimately
23 take these subsystem performance criteria, and by the use of
24 predictive methodology then just beginning development we
25 would be able to show if you meet these you meet the EPA

1 standard and you obviate any licensing calculation in a
2 probabilistic mode.

3 [Slide.]

4 MR. FEHRINGER: After considering comments on the
5 advanced notice, in 1981 we issued a proposed rule. The
6 subsystem objectives stayed somewhat the same, although
7 there was some evolution of the specifics. The philosophy
8 continued to be one of multiple barriers with specified
9 level of performance required of each of the three primary
10 barriers; 1,000 year waste package containment; one part
11 100,000 annual release rate after the containment period;
12 and, the performance objective from the site evolved to a
13 1,000 year pre-emplacment groundwater travel time.

14 In the advanced notice we were suggesting a post-
15 emplacement radionuclide travel time, and people thought
16 that would be rather difficult to work with because that
17 combines groundwater flow and geochemistry. To simplify it,
18 we tried to restrict the objective to just groundwater
19 travel time and tried to look at pre-emplacment conditions,
20 look from today backwards in history to see what happened
21 during the previous 1,000 years.

22 That was the beginning of the difficulty on that
23 objective. Missing from the proposed rule was 1,000 year
24 containment by the underground facility. We no longer
25 thought that made sense, and it was dropped. Only ten to

1 the minus fifth release rate provision was retained for that
2 part of the repository system. Again, there was no attempt
3 to correlate with the EPA standards. We continued to
4 maintain the position that these were independent criteria.

5 MR. OKRENT: Can I ask a question about the
6 thinking then of the bullet on one part 100,000. At that
7 time did you have in mind that this should be applicable to
8 all isotopes in the waste package that survived the 1,000
9 years, or did you have it in mind that this should really be
10 specific to a selected set of these or didn't you know
11 enough at that time?

12 MR. FEHRINGER: The intent was that it applied to
13 all radionuclides other than those that were present only in
14 trivial quantities. There was a provision that any
15 radionuclide that had decayed away within the first 1,000
16 years but still might have an atom or two left should be
17 exempted. Specifically cesium 137 and strontium 90 would
18 essentially disappear in the first 1,000 years. There was a
19 provision to exclude nuclides of that type that were present
20 only in trivial quantities.

21 MR. OKRENT: The second question is since some of
22 the isotopes -- fuel disposal were isotopes that had been in
23 the ground prior to them being dug up, did you in any way at
24 that time relate what you thought might be an acceptable
25 annual release rate here to what might have been released

1 had they stayed in the ground or so forth and so on?

2 MR. FEHRINGER: No, that was not a consideration.

3 MR. OKRENT: Then what was the basis for this one
4 in 100,000 annual release rate? Not having an EPA standard
5 you were setting an NRC standard it seems to me, and it
6 would be of some interest to understand the philosophy.

7 MR. FEHRINGER: There were two things that entered
8 into the development of that number. First, there were some
9 technical studies at the time that showed that you needed to
10 have a release rate of about that order of magnitude or less
11 if release rate was going to be of any value at all in
12 limiting the impacts of a repository. Expressed another
13 way, if you could not do at least that well you might as
14 well just let the waste dissolve more or less
15 instantaneously because other dispersive phenomena during
16 transport would provide the same amount of dilution of the
17 material.

18 The second consideration was technical
19 achievability. It appeared reasonable to achieve a release
20 rate of that order of magnitude without significant
21 increases in cost of the system. That latter judgment may
22 have been in error. A lot of comments said that it was
23 unfounded, but that was the consideration.

24 MR. OKRENT: In effect, the NRC could have been
25 accused of preempting EPA's role; couldn't it, by this --

1 MR. FEHRINGER: We were accused of that in public
2 comment, yes. We were accused of being arbitrary and
3 capricious and many hostile comment letters.

4 MR. OKRENT: I see, but you didn't change it.

5 MR. FEHRINGER: We did, and I will get to that on
6 the next viewgraph. We changed somewhat.

7 MR. OKRENT: Somewhat, yes. Can I understand one
8 other part. Were you weakly preoccupied with all of the
9 things that had some quantity after 1,000 years or, at that
10 time, were there a selected few?

11 MR. FEHRINGER: That was not the consideration.
12 It was thought that a waste form would dissolve fairly
13 uniformly or be leached fairly uniformly, controlled by
14 either the dissolution of the leaching rate of the matrix --
15 probably the uranium oxide matrix. All nuclides would be
16 released fairly uniformly, and there was no attempt to pick
17 particular radionuclides based on their importance to public
18 health or any other basis.

19 MR. OKRENT: There is no retardation a factor or
20 anything like that.

21 MR. FEHRINGER: The release rate provision applied
22 at the boundary of the underground facility, so any
23 retardation within engineered barriers could be considered
24 in meeting that. MR. OKRENT: I guess I missed that
25 thought in that listing.

1 MR. STEINDLER: The release rate then was measured
2 at the boundary of the whole facility in 1981?

3 MR. FEHRINGER: The engineered portion of the --

4 MR. STEINDLER: The engineered portion.

5 MR. FEHRINGER: Yes.

6 MR. OKRENT: It was the pre-emplacment
7 groundwater travel time without retardation that is shown
8 here.

9 MR. BERNERO: I think it might illuminate the
10 philosophy a little bit better to use the qualitative words
11 rather than the deterministic quantitative words that are in
12 the chart. The very first line, the 1,000 year package, is
13 a quantitative way of saying in the first place you shall
14 have substantially complete containment you won't leak for a
15 long time.

16 In the second place, when you do leak you will
17 leak very slowly. In the third place, when you do leak and
18 leak very slowly you will move out to the biosphere very
19 slowly. There certainly were misgivings that to take
20 groundwater transport pre-emplacment groundwater travel
21 time as a surrogate for radionuclide transport was really
22 evasive action in the extreme. It may simplify the
23 calculation but you may be throwing the real measure out
24 with the simplification, the real measure of radionuclide
25 transport.

1 That philosophy of in the first place don't leak
2 and in the second place if you do leak, leak slowly and in
3 the third place don't move very rapidly.

4 MR. STEINDLER: Were those bucked against some
5 target, either explicit or implicit of dose for the maximum
6 exposed individual?

7 MR. FEHRINGER: Not at this stage in the
8 development. The next viewgraph will show you where we did
9 that.

10 MR. HINZE: Before you remove that, I would like
11 to ask you a question about that.

12 MR. STEINDLER: You can't get past the 1981 rule.

13 MR. HINZE: It's great to use these subjective
14 terms that Bob has indicated, and they are very useful to
15 us. But yet, you have to put numbers on these. That is the
16 unfortunate part about it. In the balance of these various
17 barriers as you look at that first bullet, to what role did
18 technical achievability and cost come into the decision
19 regarding 1,000; where did that 1,000 come from, and how is
20 that balanced?

21 MR. FEHRINGER: That was a major question raised
22 in comments. It was the staff's judgment that a 1,000 year
23 waste package was technically achievable without significant
24 cost. The basis for that was not very well documented, and
25 I think it was pushing technology as much as based on proven

1 technology. I think it was partly a desire that this is
2 something we should try to force the applicant to provide.

3 MR. HINZE: In the nine subsequent years, do we
4 have a better handle on that, or will you be discussing that
5 with us?

6 MR. FEHRINGER: One of the things that has
7 happened is that the Department of Energy is placing more
8 emphasis on waste package containment. In the late 1970's
9 waste packages were not a significant barrier of any type,
10 and today there is a lot more talk about substantially
11 exceeding 1,000 years as a design goal for the waste
12 package. The Department's thinking has certainly evolved as
13 far as reliance on barriers.

14 MR. HINZE: How about the NRC's thinking?

15 MR. FEHRINGER: We are happy to see more reliance
16 on engineered barriers.

17 MR. BERNERO: I would like to add to that. The
18 statement is far less naive now I think because we have come
19 to appreciate more deeply that a statement of package
20 lifetime is not meaningful unless you recognize that it's a
21 statement about ten or 20,000 packages. It is not a
22 statement about one package. The whole concept has to take
23 that into account.

24 There is a lot of activity now that I am not sure
25 whether the Committee has reviewed it, especially involving

1 the center in San Antonio on the rulemaking for
2 substantially complete containment where one is trying to
3 develop a better sense of the underlying technology and the
4 expectations of what do I really expect to see in 10 or
5 20,000 packages if I make the statement 1,000 years is the
6 lifetime.

7 MR. HINZE: We have that same problem with the
8 geological characteristics. Just one fracture, that's all
9 it takes and you have wiped out.

10 MR. OKRENT: If I can come back to the point that
11 in a sense the NRC was proposing a standard if not
12 establishing a standard, this proposed rule. It didn't have
13 a good handle on costs. I did a little bit of mental
14 arithmetic assuming that a more stringent standard costs
15 only \$1 billion more than a less stringent standard to do
16 whatever we do with chemical waste by orders of magnitude.
17 Let's say \$1 billion -- if you assume that government
18 subsidy of pap tests for example would save lives at the
19 rate of \$10,000.00 per life you would get for \$1 billion ten
20 to the fifth live saved. If it costs \$100,000.00 and I
21 think the range is somewhere in there, it would be ten to
22 the fourth lives.

23 So, \$1 billion spent that way could save in fact -
24 - today's lives without having to worry about discount or
25 cures for cancer or anything -- larger than whatever it is,

1 10, 50, 100 that you might save with the EPA standard or
2 whatever this is, this roughly equivalent thing.

3 I am wondering in fact how much --

4 MR. STEINDLER: Dave, please use your microphone.

5 MR. OKRENT: -- how much philosophical thought of
6 things like this or other relevant things was involved in
7 the NRC when they were proposing a rule of this sort and did
8 it enter at all? Safety goals existed -- at least
9 discussion of safety goals for reactors existed by then and
10 people talked about things.

11 MR. FEHRINGER: There was discussion of the cost-
12 effectiveness of these barriers, and that discussion
13 included the notion that too much emphasis on cost might be
14 penny wise and pound foolish; that high level waste disposal
15 is such a controversial subject that for the first
16 repository it might make some sense to spend a little extra
17 money as an investment in public confidence and get the job
18 done. Get the stumbling block out of the way of commercial
19 use of nuclear power.

20 With that view, there was not an attempt to pin
21 down the actual cost of the performance objectives that were
22 being proposed. As I will get to on the new viewgraph, that
23 was one of the reasons that there was an evolution in these
24 objectives before the final rule.

25 MR. OKRENT: I must confess as a member of the

1 public, I wouldn't have understood the difference between a
2 table two that had one set of numbers and a table two that
3 had ten times or anything like this. I could have surely
4 understood that we are saving \$1 billion and if we were to
5 spend this in other ways you could save many more lives.

6 MR. FEHRINGER: We thought the public could
7 understand the multiple barrier concept too, of having
8 redundancy.

9 MR. OKRENT: I like in this in a qualitative sense
10 the multiple barrier concept. I am just trying to see
11 whether there had been a sufficiently rounded broad thinking
12 by the NRC staff when they went ahead.

13 MR. BERNERO: Just one more comment. I would just
14 observe that at the time as well as now, there is a very
15 weak connection between our ability to say what 1,000
16 package costs versus a 500 year package and how many health
17 effects or deaths or person rem or whatever are associated
18 with that change. The nexus to individual exposure or
19 population expose is so frail that I would question whether
20 you could even do that.

21 MR. OKRENT: I think we know the direction.

22 MR. BERNERO: Yes, but you don't know the
23 sensitivity, and that's what you need.

24 MR. MOELLER: Dan, you showed that between 1981
25 and 1979 or 1980 or something, you deleted the 1,000 year

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2 table two that had one set of numbers and a table two that
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20 you could even do that.

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22 MR. BERNERO: Yes, but you don't know the
23 sensitivity, and that's what you need.

24 MR. MOELLER: Dan, you showed that between 1981
25 and 1979 or 1980 or something, you deleted the 1,000 year

1 containment by the underground facility and you explained
2 why. Could you say that one more time.

3 MR. FEHRINGER: We didn't see that it was
4 technically achievable in the same way that the waste
5 package containment was achievable for that 1,000 year
6 groundwater travel time was achievable. It just seemed that
7 the underground facility served more to control the rate of
8 release rather than to perform a containment function.

9 MR. MOELLER: Thank you.

10 MR. COPELAND: Just to hold you up a little longer
11 Dan, in getting to the next viewgraph --

12 MR. MOELLER: Please identify yourself.

13 MR. COPELAND: I am Seth Copeland, NRC. On the
14 last bullet there, the no correlation with EPA standards, it
15 is true but I think in some ways it may oversimplify things.
16 Just by way of background, when the proposed rule came out
17 the writing of regulations is normally something that
18 involves a lot of people on the staff at the NRC. There are
19 generally a lot of different opinions that go into
20 formulating the regulations. One thread of thought that
21 existed at the time that the proposed rule was developed and
22 really even I think going back as far as the advanced notice
23 as I remember, was a recognition that the EPA standard
24 whatever it was going to be, was a standard that was going
25 to involve modeling and trying to project the future for a

1 long period of time.

2 There was a concern on the part of quite a few
3 members of the staff who were involved in developing these
4 regulations that was a very squish, iffy kind of thing. In
5 fact, I think a lot of the concerns about modeling that were
6 in the National Academy's recent rethinking report were
7 concerns that we had at the time. To a large degree the
8 criteria that found their way into proposed Part 60 and
9 particularly to performance objectives, represented a way
10 for part of the staff to sort of mollify the concerns that
11 we had and assure that at bottom there was going to be a
12 kind of fundamentally decent disposal system that had this
13 multiple barrier protection independent of the quantitative
14 standard.

15 [Slide.]

16 MR. FEHRINGER: Much of the public comment on the
17 proposed rule was very similar to your comments here. We
18 were charged with being arbitrary in setting these
19 objectives, giving no consideration to the costs that would
20 be imposed by them, and of providing no correlation between
21 them and the overall performance standard that EPA was
22 developing.

23 That led to some changes in the final rule. We
24 retained the general philosophy of having multiple barriers
25 with numerical performance objectives. An explicit

1 provision was added allowing for trade off between the
2 barriers if a particular performance objective seemed not to
3 be appropriate for a particular waste the applicant could
4 propose an alternative or the Commission could specify an
5 alternative.

6 The waste package containment time was thought to
7 be excessively burdensome at 1,000 years, so it was modified
8 to specify a range of times, 300 to 1,000 years. The
9 specific value is to be determined in some unspecified
10 manner. The annual release rate was retained as it had been
11 proposed, and the 1,000 year pre-emplacement groundwater
12 travel time was retained as it was proposed.

13 In addition to the provision for alternatives, we
14 did an analysis that showed what the relationship was
15 between these subsystem objectives and the overall standard
16 that EPA was working with at that time. The analysis showed
17 that meeting these subsystem objectives made it more likely
18 that you would achieve compliance the EPA standard but
19 also showed that the objectives were neither necessary or
20 sufficient to ensure compliance with the EPA standard. This
21 is something that we had recognized for some time, that
22 these were meant to be independent complementary
23 requirements that would build a more resilient system. They
24 were not meant to have a one to one correlation with the EPA
25 standard.

1 The analyses documented in NUREG-0804 confirmed
2 that. As I say, they are neither necessary nor sufficient
3 to ensure compliance.

4 MR. STEINDLER: The staff then was content in
5 producing a final rule apparently that was fundamentally
6 independent of the EPA standard?

7 MR. FEHRINGER: Not only content, but it was a
8 deliberate decision to do so, yes.

9 MR. STEINDLER: Did not in any of your discussions
10 the issue arise as to what should be your relationship to
11 the EPA?

12 MR. FEHRINGER: It was a major issue of contention
13 throughout the rulemaking. There were two fundamental
14 regulatory philosophies. One was called the overall systems
15 approach where a single standard of performance for the
16 overall system is specified and everything is derived from
17 that on a one to one basis. The alternative philosophy was
18 the one proposed by the NRC staff of requiring minimum
19 levels of performance from each of the major barriers in
20 order to have a partial degree of redundancy in the system.

21 As I say, it was a very controversial issue
22 throughout the rulemaking.

23 MR. STEINDLER: You could get no clues as to the
24 intent of Congress or anybody else of consequence as to
25 which of those two somewhat incompatible philosophies you

1 ought to be following; is that right?

2 MR. FEHRINGER: The Waste Policy Act does specify
3 that multiple barriers are to be a part of a repository
4 system. We felt that Congress had endorsed something
5 similar to our regulation.

6 MR. STEINDLER: The Waste Policy Act was not in
7 existence in 1983, was it?

8 MR. FEHRINGER: It passed in 1982.

9 MR. STEINDLER: Passed in 1982, okay.

10 MR. BERNERO: Also, for quite some time EPA has
11 called in their standard on and off for multiple barrier
12 concept and so forth. There was great deal of debate about
13 whose job is it to implement that. I think the important
14 thing on that slide, if you look at the second last line the
15 objectives are neither necessary nor sufficient to ensure
16 compliance. At that time, a lot of people in the NRC felt
17 frustrated that it couldn't be shown that they are
18 sufficient to ensure compliance.

19 Yet, in contrast, there wasn't a strong enough
20 opinion to say we need this alternative -- this
21 complementary standard of defense in depth to ensure the
22 uncertain modeling and calculations against the EPA
23 standard, to have an alternative, an independent way to test
24 our commitment here of this system. That is germane today.

25 When people ask the question of whether the one

1 should have a margin producing defense in depth approach as
2 a supplement or complement to an overall system analysis --
3 when I look back at the 1983 rule, I think the word
4 necessary could have been the subject of greater debate than
5 did occur then.

6 MR. ORTH: I was waiting to get to this slide too,
7 because it was referred to earlier that we might get an
8 answer to it, and it was something that was raised before.

9 As NUREG-0804 shows and as you noted before, it is
10 possible for DOE to recommend "an alternative release rate
11 for nuclides in light of the standard." This applies to
12 that one in 100,000 number. Am I to observe that the one in
13 100,000 as has been also noted, has no risk base for it; it
14 was a considered something that you could put out and DOE
15 can say you can do something different or they can apply for
16 an alternative release rate.

17 There are a great deal of radionuclides in there
18 in which one in 100,000 exceeding that would create no
19 hazard at all because there just aren't very much of them
20 there. If they all come out they do not hurt anybody, this
21 doesn't mean that I am against multiple containment. Has
22 DOE or has the staff considered in detail exempting some
23 given quantity of given radionuclides that obviously pose no
24 problem from that one in 100,000 rule?

25 MR. BERNERO: If I may, Dan. We certainly are

1 looking at it right now on Carbon-14 because we got a poor
2 site as well. I think it is a given that in the analysis we
3 would have to look at that and be compelled to look at it
4 when we discover something like Carbon-14, which on the face
5 of it appears to be an innocuous release; the rates, the
6 quantities, and the excess to the biosphere.

7 I would point out that if you look at NUREG-0804
8 results, this is also the real teeth in these standards.
9 The 1,000 year groundwater travel time, as I recall doesn't
10 really buy you a whole lot, because it doesn't represent
11 radionuclide transport. It doesn't have geochronology in it.
12 That one in 100,000 really hurts. That is tight

13 MR. ORTH: I accept all of that. It is the real
14 teeth. Again, the question is, are we biting at something
15 with those teeth that doesn't need chewing on specific
16 radionuclides?

17 MR. BERNERO: No. I think the regulatory system
18 is prepared to cope with those as they are analyzed and
19 identified. We are doing --

20 MR. ORTH: The other part of the question was, has
21 DOE ever come in and said here are some things that don't
22 matter. That is what I am interested in pursuing.

23 MR. BERNERO: That's the Carbon -14.

24 MR. ORTH: Just the Carbon-14?

25 MR. BERNERO: I wasn't sure whether you were aware

1 of that.

2 MR. ORTH: I am quite aware of Carbon-14.

3 MR. BERNERO: They have singled that out and done
4 papers and we are looking at that right now.

5 MR. ORTH: What about other things though?

6 MR. BERNERO: I don't know.

7 MR. FEHRINGER: I am not aware of any others
8 identified. They have not even addressed Carbon-14 in a
9 formal request for an alternative.

10 MR. STEINDLER: We had a working group meeting on
11 Carbon-14 relatively recently.

12 MR. OKRENT: This rule doesn't mention how well
13 one needs to know these things, the uncertainties. Is this
14 just the state of affairs?

15 MR. BERNERO: Yes, that's the state of affairs
16 with every rule that we have ever put out. I don't know of
17 a rule that we are right now looking at substantially
18 complete containment which is the operative words that go
19 with that mushy three hundred to 1,000 years. The
20 substantially containment, it will either be rulemaking or
21 guidance that goes with a rulemaking that would specifically
22 address the uncertainty and how to deal with it.

23 We are trying to do that in an itemized way
24 throughout the thing. This rule does not address that
25 specifically.

1 MR. OKRENT: The other question is, if there were
2 no EPA rule or standard and they gave up, does the staff
3 think that a repository which complied with 10 CFR Part 60
4 would be one for which there was adequate assurance that the
5 public health and safety was protected.

6 MR. FEHRINGER: Those subsystem objectives first
7 of all, are limited only to what are called anticipated
8 processes and events. They do not even address releases for
9 the whole class of unanticipated. There would be a need for
10 additional regulatory criteria.

11 MR. BERNERO: I would like to interject on that.
12 If you go back to the 1980 through 1985 rulemaking period, I
13 think it is fair to say that there was a presumption that
14 the health related standard of EPA was adequate to ensure
15 appropriate protection of the public health and safety.

16 The focus was on whether the NRC standard was
17 appropriate to implement that standard and, indeed, whether
18 it might be sufficient. There was a long held hope that it
19 would be sufficient so that you wouldn't have to do the
20 modeling and calculations and all the argument.

21 I know of no independent analysis that related the
22 deterministic Part 60 directly to population dose,
23 individual dose or some other representation of health risk.
24 In order to make an independent evaluation of it you would
25 have to do that. In order to say I therefore consider this

1 adequate. There was a very strong hope that it would be
2 sufficient, these three things -- this defense in depth is
3 adequate because it demonstrates compliance with the EPA
4 standard which in its turn is a demonstration of adequate
5 protection of the public health and safety QED.

6 MR. OKRENT: This was in 1983. In 1990 do there
7 exist the analyses that compare the Part 60 with whatever
8 recent version of EPA standard you can think of? We still -
9 - that is still the situation.

10 MR. BERNERO: I would say that's still the
11 situation, although we are now -- I wasn't in the
12 Albuquerque workshop of the week after Thanksgiving -- we
13 are now getting to the state where a large number of
14 calculations are coming up that can illuminate the question
15 and may indeed show that this has an nexus or doesn't have a
16 nexus to adequate safety.

17 MR. OKRENT: No paper that one can read on this?

18 MR. BERNERO: Not that I know of.

19 MR. COPELAND: This is getting a few viewgraphs
20 ahead, but I think Dan is going to talk about some of the
21 work that we are planning to do. That does include some
22 modeling that would be looking at the effects of the
23 subsystem requirements as they relate to the EPA standard.

24 MR. HINZE: Before we leave this transparency, I
25 would like to explore with you the background before the

1 change in the philosophy, the major difference between the
2 1981 situation and the 1983 is the trade off situation.

3 I would like to learn a little bit more about what
4 drove that situation, was it a realization that you were
5 talking about, a generic repository, and there were a lot of
6 geological conditions that you were trying to cover within
7 one rule. At that time there were several different options
8 available to DOE in terms of repository.

9 Was it the geological factors and the
10 uncertainties in the geology of these sites, of the possible
11 sites that drove this, or what was it?

12 MR. FEHRINGER: It was partly that and it was
13 partly a recognition that there is a variety of waste types
14 existing, particularly in the defense program. Some of the
15 high level waste -- especially at Hanford -- have been split
16 up into different fractions. It might not make sense to
17 apply both of the engineered barrier performance objectives
18 to each of those fractions. The cesium and strontium that
19 are short-lived have been separated and a canister alone
20 might be appropriate for those without application of a
21 release rate provision for example.

22 A third consideration was the notion that we could
23 not show it was necessary to achieve these at all for all
24 repository designs. A release rate marginally greater than
25 ten to the minus fifth might be adequate in some

1 circumstances, and we could just not bring ourselves to
2 insist that the requirement must be met in all cases.

3 It was just a backing off from the rigidity of the
4 objectives as they had been stated in the proposed rule,
5 because we couldn't defend the need for them.

6 MR. STEINDLER: I guess I am still confused a
7 little or a lot. Did the staff, in fact, look at the
8 relationship in 1983 between the ability to -- the meeting
9 of the standards as you interpreted the EPA direction to go
10 and the issues that are raised by the 1983 rule. Your last
11 slide down there shows more likely to meet the EPA
12 standards. More likely than what?

13 MR. FEHRINGER: Than if the performance objectives
14 are not achieved.

15 MR. STEINDLER: Not present at all?

16 MR. FEHRINGER: Yes. The analyses we did were
17 essentially a generic set of uncertainty analyses for
18 hypothetical repositories. We defined a range of parameters
19 for waste package containment, release rate, groundwater
20 travel time and geochemical conditions, and did an
21 uncertainty and sensitivity analysis to determine when you
22 would meet the EPA standard as it existed then and when you
23 would not.

24 Not surprisingly, when you met the subsystem
25 performance objectives you were more likely to meet the

1 standard than in those cases where you did not meet the
2 subsystem performance objectives. You could not show a one
3 to one correlation because a site with very favorable
4 geochemical conditions might be able to meet the EPA
5 standard without meeting the subsystem objectives.

6 Similarly, if you had very lousy geochemical
7 conditions even meeting the subsystem objectives did not
8 ensure compliance with the EPA standard. We were able to
9 show a correlation less than one.

10 Let me make one other point before I go on. A lot
11 of public comments said there should be a one to one
12 correspondence between the EPA standard and the subsystem
13 objectives. We did not disagree with that, that was a fine
14 goal and we tried very hard to produce that kind of one to
15 one relationship. What we found is that we could not do
16 that without placing tremendously tight constraints on the
17 design of a repository system. Essentially, we would have
18 been designing it ourselves.

19 That was something that we thought was even less
20 desirable than the performance objectives that we developed.
21 These leave some flexibility for the department to trade off
22 one barrier against another even without resorting to the
23 alternatives provision. Waste package greater than 1,000
24 years can be considered, but it does not need to be for
25 example.

1 MR. STEINDLER: Which part of the EPA standard
2 were you looking at when you concluded that?

3 MR. FEHRINGER: At the time, the only requirement
4 in the working drafts was the containment requirements, and
5 that was one of the early working drafts.

6 MR. STEINDLER: It is their so-called table one.

7 MR. FEHRINGER: Yes.

8 MR. STEINDLER: You didn't try to do this in
9 relationship to the 1,000 deaths in 10,000 years overall
10 goal.

11 MR. FEHRINGER: No, we did not carry it out to the
12 health effects calculations. We stopped at releases.

13 MR. BERNERO: Excuse me. Dan gives the entry to
14 bring up a very important philosophical point. It relates
15 to recent Commission comment or guidance in implementing
16 safety goals in reactors. Right or wrong, if you take the
17 EPA release limits as the true representation of acceptable
18 safety, you can have a system of subsystem performance
19 requirements -- three consecutive margins of safety -- that
20 numerically add up to that. If you knew them very well and
21 very precisely that they all have to add up to \$1.00 and you
22 get 33 cents out of each one of them, that is an exact
23 compliance with risk.

24 Where, in contrast, a margin of safety approach
25 would be if I have to add up to \$1.00 and I recognize the

1 uncertainties of it, I want 50 cents apiece or \$1.00 apiece
2 from these containments.

3 If you go to the reactor analogy, the core should
4 be very unlikely to melt and should it melt, the containment
5 should most likely substantially mitigate its consequences.
6 Third, the site and whatever protective measures are
7 available with it should be such that the likelihood of
8 death or excessive radiation exposure is averted.

9 If you look at the guidance that is now being
10 discussed -- and it's a very significant point -- is the
11 overall risk of the safety goal, the dollar, the sum of 33
12 cents worth of core, 33 cents worth of containment and 33
13 cents worth of site. Or, should they be 50, 50, 50 or
14 whatever other, overlapping or margin producing measure.
15 That is a very significant point in the current debate about
16 whether to have complementary regulations because many argue
17 today that these three elements of subsystem performance
18 criteria are 33 cent elements.

19 MR. OKRENT: I am a little confused. It is my
20 impression that the Commission has said or that it has a
21 safety goal and, however -- core melt and containment
22 efficacy and offsite measures -- if you are going to do a
23 comparison against the safety goal it should meet, and not
24 that it should meet by three times better or whatever. In
25 fact, my impression is that the Commission said it's nice if

1 EPRI seems to have something more stringent, but we are
2 going to stay with our current safety goal for the current
3 state of affairs.

4 I am not sure to what part of the safety goal you
5 are referring. There has been a long standing discussion as
6 far as I can recall about this very defense in depth
7 argument that the staff wants for high level waste -- where
8 the ACRS was saying you really ought to have it for reactors
9 and you ought to have a step in there that says the
10 containment is one of the barriers. The staff -- back when
11 I knew what was going on -- never quite took a position of
12 individuals, they may have been more strongly expressive
13 than others.

14 What you are saying now is very ambiguous as to --

15 MR. BERNERO: I am not trying to bring in here any
16 debate on the reactor safety goals or reactor safety in
17 containment performance criteria. What I am trying to bring
18 out is the point, in evaluating subsystem performance
19 criteria and the merit of having them in the regulatory
20 system as compared to an overall system criterion of release
21 rate standard such as EPA has, that one shall have to
22 consider whether the simultaneous presence or supplanting of
23 one with the other entails subsystem performance criteria
24 that are intended in sum to be equivalent or intended in sum
25 to provide some margin, some additional level of assurance

1 if that level of criterion -- namely the EPA standard is,
2 indeed, an apt representation of adequate safety.

3 The key is, are these three things to be
4 equivalent to the EPA release in toto taken in aggregate --
5 are they equivalent to EPA release or are they a
6 conservative choice that gives margin in order to cope with
7 error in modeling or lack of knowledge of geochemistry or
8 whatever.

9 MR. STEINDLER: I think the problem is more
10 complex than that, because you have already indicated at
11 least on the basis of that NUREG document that the
12 objectives are not necessary. If they are not necessary and
13 there are no other objectives that are reasonably clearly
14 spelled out except somewhere buried in some of the words as
15 to oh, by the way, you have to meet all the EPA criteria --
16 then you leave it to the applicant to devise methods above
17 and beyond the three that you have specified. In other
18 words, devise his or her own subsystem requirements in order
19 to meet that catch all, namely you have to meet the EPA
20 criteria.

21 You eventually get to the -- I can drive myself to
22 the point of saying those three that you have up there are
23 not very useful.

24 MR. BERNERO: That's only because -- I want to
25 bring you back to the words that I said before -- that line

1 is very important. At the time that conclusion is made,
2 they are neither necessary nor sufficient. Both necessary
3 and sufficient were disappointing words. There had been the
4 hope that they would be sufficient to supplant the EPA
5 standard, to be a clear demonstration that it would be
6 satisfied.

7 There was also an unwillingness -- to me it was a
8 disappointment -- an unwillingness to say recognizing the
9 foreseeable uncertainty of an overall system performance
10 estimate going out into tens of thousands of years and even
11 using a surrogate time of calculation, that one would be
12 foolish not to have an orthogonal way to evaluate safety in
13 relatively independent terms and taking advantage of
14 available barriers.

15 Therefore, it would be a conclusion that the
16 defense in depth of three subsystem performance criteria
17 intelligently cast would be necessary to be able to say with
18 sufficient confidence I have tested this thing two different
19 ways, I have tested it by three subsystem performance
20 criteria relative deterministically judgmental, best
21 engineering judgment, and I have also done the very best
22 that I can with the state of the art of prediction.

23 That is an extremely important consideration today
24 in answering the very question that is the occasion of this
25 meeting. That is, is it sensible to go with the predictive

1 modeling alone -- you know the debate we are having about is
2 it an unduly stringent standard, is it an unduly lax
3 standard, or is it even a relevant standard the way it is
4 cast. The issue is, should the regulatory system put all of
5 its eggs, all of the basis of adequate safety judgment on a
6 very complex, very long range, very uncertain performance
7 prediction or should it instead say I can't prove that the
8 performance prediction is satisfied by some alternative
9 means.

10 I can provide a substantial margin of basis -- a
11 substantial basis for a regulatory judgment that, having
12 exploited the barriers to almost best available control
13 technology degree -- exploited them intelligently, that I
14 have sufficient in toto -- therefore, two way of judging is
15 necessary for adequate safety. I would just invite your
16 attention -- I think you have been briefed on the WIPP
17 project. The WIPP system does not have subsystem
18 performance criteria. It is a gaping hole.

19 The best I can perceive, that is a very good site.
20 That salt bed is a very good site. Unprocessed, unpackaged
21 waste is making it very hard to deal with that site.

22 MR. STEINDLER: You've identified I think
23 eloquently the overriding problem. I don't sense, however -
24 - my confusion is that I don't think that is what Curtis
25 asked. I think Curtis might well agree that those two

1 methodologies for coming to the comfortable conclusion that
2 we have met the EPA targets are necessary.

3 What he is asking is, have we picked the right
4 subsystem requirements? If you go through the exercise that
5 you have just outlined which is necessary and the WIPP
6 example is a good one, and you say we have three that are
7 written in the current rules -- the NRC rules. Are they
8 relevant, are they the right ones? Shouldn't there maybe be
9 others?

10 The WIPP people can legitimately ask, not having
11 any at all, if they were confronted with this question and
12 somebody said you have to find a few. Go dig yourself up
13 three subsystem requirements someplace, would they pick
14 these? Should they pick these? I think that is the essence
15 of what I sense to be Curtis' question, not having to the
16 Commissioner, you understand.

17 MR. BERNERO: Let me add, I don't recall the exact
18 words of his request to you. I would dare to speak for the
19 Commissioner here from repeated discussions with him
20 personally, where he is asking both questions. He has
21 specifically raised with us and the staff repeatedly whether
22 it is sensible to have redundant systems of finding. The
23 attendant litigative risk, you know, it is almost like
24 having two hearing boards. One of them is litigating the
25 subsystem performance criteria and the other is litigating

1 the EPA standard.

2 Does that make sense, because he tends to view
3 them as an equivalent I think and as simply redundant. He
4 is asking the questions, are both necessary. Whichever one
5 is necessary and sufficient, is it the right one, whether it
6 is the EPA standard or the subsystem performance criteria.

7 MR. STEINDLER: If we are here to address the
8 issue of are both necessary then we have to get through your
9 presentation Dan, because there are a lot of other things
10 that we need to cover. I am not sure we are quite prepared
11 to --

12 MR. OKRENT: Of course, we heard that --

13 MR. STEINDLER: Use your microphone.

14 MR. OKRENT: --disturbed state considerations are
15 not necessarily covered by what you have here. There is
16 another area that would have to be thought on. Just as a
17 trial balloon, it seems to me in view of the very
18 quantitative uncertainties in trying to evaluate either
19 release quantities or individual risk, if the NRC could come
20 up with a set of barriers and criteria that they were
21 satisfied they were met provided them with reasonable
22 assurance -- independent of whatever calculations with
23 regard to the EPA standard that said yea or nay, and that
24 they said if these are met we think that provides an
25 adequate basis for licensing.

1 It's not that you have to meet both but if you can
2 meet these, the NRC will take the position that these
3 provide an adequate basis. In fact, the better basis in
4 view of all these other kinds of uncertainties and so forth
5 -- that might be advantageous. I don't know whether that is
6 in their thinking. That isn't quite what Bernero said, I
7 didn't think. I don't know if they think they can develop
8 such.

9 I will just throw out the --

10 MR. BERNERO: I will just say to you what I have
11 said internally. If you ever sit -- and I have done this
12 with NUREG-0804 and read it and contemplate it and feel
13 frustrated -- there is a system of deterministic
14 requirements that I think -- this is a prognosis, it's not
15 based on existing analysis. It is a prognosis that if you
16 took state of the art methodology and analyzed the thing
17 parametrically, changing bullet two to ten to the minus six
18 instead of ten to the minus five is all you need. You don't
19 get there from here.

20 Rather, I think we are condemned. If you look at
21 the system you recall that Bob Browning wrote a letter to
22 EPA, our comments on the draft number two -- June or July or
23 something like that, this past summer -- you look in there
24 and what you find in the analysis for an EPA standard you
25 find creeping determinism.

1 [Laughter.]

2 You find that for the upset conditions what do
3 these folks -- we have some very expert staff that are
4 saying my God you are never going to write a CCDF that is
5 rigorous for all of this. You are out in the ten to the
6 minus gnats eyelash. What you are going to do is, you write
7 a CCDF for pre-upset conditions or normal conditions. Then
8 you will take the upset conditions one at a time and analyze
9 them by a unique, deterministic method. That is what those
10 comments say. That's probably how we would implement that
11 standard.

12 If that standard ever evolved into 10,000 year or
13 50,000 year population doses or individual doses, my God, we
14 really have to have creeping determinism in order to analyze
15 that. If you come back, I think the tantalizing hope that a
16 simple deterministic set could replace everything could
17 totally replace prediction, is only going to work if you
18 take a deterministic bounds so conservative that it is
19 useless. I think what you need is a cunning combination of
20 predictive standard and deterministic standard.

21 MR. COPELAND: I would like to add maybe one more
22 example to that of, the original goal was to try to come up
23 with some sufficient set of deterministic criteria that
24 would have supplanted the EPA standard. Going back to even
25 before that advanced notice in 1980 in an effort to try to

1 deal with the possible upset conditions in a deterministic
2 way, we were writing what was sort of the precursor to
3 60.122 which is the potentially adverse and favorable
4 conditions.

5 If you go back and look at 60.122 but instead of
6 having all the language that relates them back to the
7 performance objectives, you read something or substitute
8 words that go something like this. The following conditions
9 shall exist within one kilometer of the potential
10 repository, and then you have the list of favorable
11 conditions. Then, the following conditions shall not exist
12 within one kilometer of the repository site and you have the
13 potentially adverse conditions.

14 That is what was appearing in some of the working
15 drafts that we had prior to the advanced notice. I recall
16 one session that we had with the ACRS Subcommittee where we
17 came down with our working draft 10, and went through those
18 criteria. We had been working so close to them ourselves
19 that we thought that's not so bad. We were disappointed to
20 be told if you put anything like that in place you won't
21 have a site anywhere in the country that could meet those
22 criteria. We went back and started looking at them again,
23 and we had to agree. Over a period of time we worked our
24 way around to the language that is in there now.

25 Just sort of time after time we found that in

1 trying to develop sufficient deterministic conditions to
2 just completely substitute for the EPA standards we were
3 building something that was so proscriptive and so
4 conservative that it just wasn't really practical.

5 MR. STEINDLER: Let's move on.

6 [Slide.]

7 MR. FEHRINGER: That brings us to the current
8 status of the rule. The subsystem objectives remain as they
9 were in 1983. We have had several amendments to the rule
10 but that section of the rule has not been changed. We
11 continue to have criticism, both by the Department of Energy
12 and by the technical community at large -- that includes
13 individuals within the NRC staff -- for two basic reasons
14 for criticism.

15 The first is disagreement with the basic
16 regulatory philosophy. We have not been successful in
17 convincing people that the multiple barrier approach of this
18 rule is a proper way to regulate a repository. Many people
19 would prefer what we called the overall systems approach
20 when the rule was developed. Set an overall system
21 performance objective and allow the applicant to determine
22 what barriers will be used to meet that goal.

23 The other more recent variation on the philosophy
24 is that articulated by Commissioner Curtis. Having a set of
25 subsystem objectives that are sufficient to demonstrate

1 compliance with the EPA standard. We had thought it was
2 impossible to do that when we were developing the current
3 rule, but Commissioner Curtis is asking us to take another
4 look at the possibility of doing so.

5 There also are problems with the specific wording
6 of some of the performance objectives, the groundwater
7 travel time in particular has caused a lot of troubles. We
8 have efforts underway to fix that. There may be
9 difficulties with substantially complete containment
10 provision, and we also have an effort to re-evaluate the
11 wording of that objective.

12 MR. STEINDLER: What is the concern about the
13 groundwater travel time?

14 MR. FEHRINGER: The groundwater travel time has
15 several terms that were meant to make the provision either
16 easier to implement or more appropriate, and they have
17 turned out to cause difficulty. There is the phrase the
18 fastest path of likely radionuclide travel. Hydrologists
19 now think that there is no single velocity of groundwater
20 travel but quite a long range, and that along some path some
21 very small fraction of the groundwater flow will be
22 traveling very rapidly. Identifying that fastest path or
23 interpreting its meaning is causing great difficulty.

24 The whole notion of a pre-emplacment groundwater
25 travel time objective is a big question. There may not be

1 as strong a correlation between pre-emplacment conditions
2 and post-emplacment performance as we had thought when the
3 rule was developed. I think those are the main difficulties
4 that the objective has.

5 [Slide.]

6 With substantially complete containment, the
7 question is the one that Dr. Okrent raised, what does
8 substantially complete mean. There are thoughts that a
9 numerical definition of substantially complete might be
10 preferable to the qualitative wording that is now in the
11 rule. We also have begun to think about ways to reword the
12 flexibility provision. A number of people are apprehensive
13 that the provision will look like an exemption from
14 regulatory requirements if it is ever exercised. It is not
15 intended to be that.

16 It is intended to be a provision that allows the
17 regulator and the applicant to make sense out of a
18 particular repository design. We want to make sure that
19 there is no appearance of granting the applicant an
20 exemption if an alternative is ever requested or specified
21 by the Commission.

22 MR. HINZE: Is the concern about the groundwater
23 travel time specifically designed for Yucca Mountain, or are
24 we still talking about a generic repository?

25 MR. FEHRINGER: It's a generic problem.

1 Hydrologists just don't know what the wording means. They
2 can't relate it to the physics of groundwater flow. They
3 are at a loss to figure out how to evaluate compliance with
4 it. It is not unique to Yucca Mountain, although the
5 unsaturated flow adds one more level of complexity at that
6 site.

7 MR. HINZE: How is the staff going about looking
8 at this problem, what is the procedures?

9 MR. FEHRINGER: We have a contractor examining the
10 current wording and alternatives to it, and beyond that I am
11 not familiar with the project enough to tell you.

12 MR. HINZE: Who is that contract with?

13 MR. FEHRINGER: That is the Center.

14 MR. OKRENT: Isn't there only some probability
15 that radioactive material which were released from a
16 container would follow the path of most rapid flow. To
17 assume that it all does is really not necessarily good
18 physics or good regulation.

19 MR. BERNERO: We said before in the earliest time,
20 if the ground transport of radioisotopes is the figure of
21 merit that you want, you would like to associate some figure
22 of merit like that -- it is a drastic simplification just to
23 use the groundwater travel time. It does not take into
24 account the Geochemistry, et cetera.

25 MR. FEHRINGER: Groundwater travel time was meant

1 to be a surrogate measure of how good a site was. The
2 problem seems to be that surrogate is too far removed from
3 reality, that we should get back closer to actual
4 radionuclide transport as the measure of the goodness of a
5 site.

6 MR. STEINDLER: That trades you off with one set
7 of arguments with hydrologists with another set of arguments
8 with chemists.

9 MR. FEHRINGER: Exactly.

10 [Slide.]

11 In addition to the efforts we have underway on the
12 wording, we also have a project to do performance
13 assessments, develop a capability first to evaluate both
14 individual barrier and overall system performance and then
15 to exercise that capability for the Yucca Mountain site.
16 You were briefed recently on the first phase of that
17 performance assessment effort, and the second effort is just
18 now being initiated. It will cover approximately the next
19 18 months.

20 That will give us a better capability to equate
21 these subsystem performance objectives to actual performance
22 at a realistic site and determine what the relationship is
23 between the subsystem objectives and the standards that EPA
24 is developing.

25 MR. OKRENT: Can I ask a leading question? How

1 are you factoring expert opinion into your measurements?

2 MR. COPELAND: I have my instructions --

3 [Laughter.]

4 Unfortunately, they have been rescinded. I guess
5 the best answer that I can give to that is, in the
6 performance assessments that we are doing we are trying to
7 do the analyses in a mechanistic a way as we can. The
8 expert judgments really are those of the analysts, the
9 various people in the earth sciences that provide input,
10 make judgments about the data and interpretations of the
11 data almost at the parameter level. Of course, also, in
12 some of the interpretations that lead to the way we model
13 certain phenomena themselves.

14 We haven't tried to do this in any kind of a
15 formal way such as an expert solicitation or any of that
16 kind of thing. Certainly in phase II, I wouldn't expect
17 that we are going to.

18 MR. OKRENT: You have to assume there are some
19 initiators for which you have difficulty in providing data.
20 I will take climate change as one example. I don't see how
21 you can ignore it if you are doing a performance assessment
22 for Yucca Mountain.

23 MR. COPELAND: I think maybe two points of --

24 MR. OKRENT: Except sensitivity studies which in
25 the end only tell you if there is a change there will be

1 such a result, but don't really say how much change they
2 think the experts --

3 MR. COPELAND: Even in Phase II where we are
4 gearing up to do more detailed and more realistic piece of
5 work than we did in Phase I, we are still not trying to do a
6 full performance assessment of Yucca Mountain. We are going
7 to try to stay focused on a few scenarios and do those in a
8 much more realistic and thorough and rigorous fashion than
9 what we did earlier.

10 Climate change will probably be one of those, but
11 I think we would tend to focus on what is available in the
12 literature rather than try to invent anything on our own
13 there.

14 MR. BERNERO: I would like to amplify if I could,
15 please. First of all, I want to make the point that we are
16 trying to do our performance assessment in order to have a
17 rulemaking or regulatory capability and an independent
18 review capability, and we expect the Department of Energy --
19 which has vastly more effort on this than we do -- to have
20 a more splendid use of expert opinion.

21 However, I would like to point out on the one
22 example of climatology which in my view is not an upset
23 condition but an expected condition, that this is crucial to
24 the standard itself and how it ultimately deals with a
25 reference time of calculation namely 10,000 years and

1 looking over the edge of the cliff so to speak by saying and
2 also consider or use judgment about what you would foresee
3 happening in about 50 or 100,000 years because of the nature
4 of the long-lived nuclides and maybe all the excitement
5 comes at 23,000 years instead of 10,000 years.

6 That is something we have to do separately, and
7 that is probably the most significant place where the
8 overall modeling and expert opinion on the overall modeling
9 is going to be most crucial. Whereas, in the other modeling
10 it is more at the parameter level than I think it would be
11 most crucial.

12 MR. STEINDLER: Let me suggest that the next three
13 viewgraphs that Dan has focus pretty sharply on the original
14 thought that I had on what this topic was supposed to
15 address. Let's give him a chance to -- we are only one-half
16 hour behind schedule.

17 MR. BERNERO: He's very verbose.

18 [Laughter.]

19 MR. STEINDLER: I noticed that.

20 [Slide.]

21 MR. FEHRINGER: Finally, on the future efforts, I
22 would like to discuss what we call the conforming
23 amendments. When EPA issues their standards we plan to
24 incorporate the applicable portions of those standards
25 directly into Part 60. There may be some translation of

1 terms so that EPA's terminology is changed to fit the
2 terminology of Part 60. But other than that, it would be a
3 direct adoption of their requirements.

4 At that time we will re-evaluate the relationship
5 between EPA standards and the subsystem performance
6 objectives. EPA's release limits in the 1985 standards had
7 already been increased compared to the release limits that
8 were used in developing NUREG-0804. We need to update the
9 analyses to take that into account. In 1985 EPA had added
10 individual and groundwater protection requirements, and
11 there has never been an analysis of the relationship between
12 those and the subsystem performance objectives.

13 There may be other changes when the standards are
14 reissued this time, in particular the Carbon-14 release
15 limits have been questioned. EPA needs to decide what will
16 be done about those. We need an update of our thinking on
17 the relationship between the two, and the conforming
18 amendments will be the vehicle for providing that.

19 [Slide.]

20 Something of a timeline to show where we are at.
21 We have iterative performance assessment that was just
22 mentioned. That will provide part of the technical input to
23 provide the relationship of EPA standards to the overall
24 system performance objectives. The second phase is
25 indicated by the solid arrow, the dash just indicates that

1 we expect a third phase to continue on.

2 We have a project called systematic regulatory
3 analysis that is underway at the Center. That project is
4 examining all of the regulatory requirements applicable to a
5 repository, both our and EPA's, and looking for
6 uncertainties and potential problems in applying those
7 regulatory requirements. We expect that will get into the
8 question of relationship between the subsystem objectives
9 and EPA standards.

10 At whatever time F/A issues their standards, we
11 will initiate our conforming amendments rulemaking. If we
12 need to amend the subsystem objectives that will be the
13 vehicle where we will propose changes.

14 [Slide.]

15 The range of alternatives that we are considering
16 is indicated on the last viewgraph. The first alternative
17 would be to retain what I have called the complementary
18 objectives or independent objectives but fine-tune the
19 wording to eliminate the problems we already know exist,
20 particularly with the alternatives provision. I discussed
21 that a minute ago. Make more clear that is not an exemption
22 from regulatory requirements.

23 The extremes of alternatives that we might
24 consider would be to develop objectives with a one to one
25 correspondence to EPA standards. We tried that the last

1 time and found that it is very difficult to do on a generic
2 basis, and if you do it, it takes away all the applicant's
3 flexibility to design his system. Effectively we would be
4 designing the system for him. So, we are not optimistic
5 about being able to do that, but we will look at the
6 possibility of it.

7 The opposite extreme is to delete the performance
8 objectives or make them guidance, particularly the numerical
9 parts of them. The Department of Energy has recommended
10 that, and we will consider that. It also is not an
11 alternative that we look upon favorably. One of our initial
12 objectives was to get the Department of Energy to place more
13 emphasis on engineered barriers. They are now doing so, and
14 this may be a more palatable alternative than it seemed back
15 in 1983.

16 That's where we are at and where we are going.
17 Your recommendation on this subject will certainly help
18 guide us in pursuing this.

19 MR. STEINDLER: We currently are faced with three
20 subsystem requirements that we have been talking about. In
21 the view of the staff, to what extent are those three
22 requirements unique? To put it somewhat differently,
23 supposing the NRC regulation simply says devise your own and
24 come and tell us why you think they are any good, and then
25 go forth and do likewise. If I were to be allowed that

1 option, is it in the judgment of the staff likely that I
2 would come up with the same three?

3 MR. FEHRINGER: I think not. I think there would
4 be a tendency to emphasize one barrier and place much of the
5 design emphasis on the single barrier. That was the
6 philosophy in the late 1970's, and it was the design
7 philosophy we tried to get the Department of Energy to move
8 away from by developing these objectives.

9 MR. STEINDLER: You rejected that because you saw
10 no relationship between it and the EPA, or you rejected that
11 because you didn't think it could be made to work?

12 MR. FEHRINGER: Because we didn't think it was
13 wise to place all of one's eggs in one's basket. We wanted
14 a system that was more resistant to the unexpected
15 difficulties that might crop up, the unforeseen disruptions
16 and that sort of thing.

17 MR. STEINDLER: Having decided that multiple
18 redundancy in those subsystems is a requirement, you
19 nevertheless elected or were driven to the position where
20 you don't really know whether those three subsystems are of
21 any use?

22 MR. FEHRINGER: I think we showed in NUREG-0804
23 that they are of use. You cannot say they are necessary.

24 MR. STEINDLER: They are neither necessary nor
25 sufficient --

1 MR. FEHRINGER: Right.

2 MR. STEINDLER: You do wonder if they are neither
3 necessary or sufficient, why bother. I am not saying that
4 the concept of having subsystems for redundancy is being
5 thrown out. Those specific ones apparently are
6 characterized by neither being necessary or sufficient.
7 They could very well be the wrong ones in a sense.

8 MR. FEHRINGER: If your philosophy is to build a
9 minimal repository where you string together only the bare
10 minimum number of barriers that is necessary to meet the
11 overall system standard, then you would be correct that some
12 of those could be the wrong ones. If your philosophy is to
13 have a system that exceeds the minimum in some way making it
14 more resistant to surprises, then I think the objectives we
15 have accomplish that to some degree.

16 I wouldn't argue that they are the only set that
17 could have been picked but they do tend to cause the
18 applicant to have diverse barriers, both natural barriers
19 and engineered barriers, and barriers that have some
20 resistance to common cause failures.

21 MR. STEINDLER: Let me try it another way. Since
22 the EPA criteria are silent on specifying the kind of
23 redundancy that should be required on the part of the NRC,
24 perhaps one drives then to the conclusion that whatever the
25 subsystem objectives are that you folks have put into the

1 regulations there need not be any relationship between them
2 and whatever the EPA writes.

3 Is that a legitimate view in your eyes? In effect
4 what Curtis is saying is he is asking a question that it's
5 the wrong question.

6 MR. FEHRINGER: I think there's a fundamental
7 difference of regulatory philosophy of whether one has only
8 the emphasis on the overall system or whether one has a
9 multiple barrier concept.

10 MR. BERNERO: I would like to add to it. As I
11 have said before, I am not terribly comfortable with the
12 neither necessary nor sufficient. In fact, I think it would
13 provide a more illuminating comment if it said they provide
14 substantial assurance but not quite sufficiency to
15 demonstrate compliance with the EPA standard.

16 The identity of the three subsystems is there. I
17 mean, it is containment, it is the engineered transport and
18 the site transport. You could argue whether groundwater
19 travel time is an apt measure of site transport. The degree
20 of reliance one would put or the amount of reliance one
21 would put on any one of them, if left to the applicant,
22 might give you something that -- in fact, I think it's an
23 open question. EPA has said and we even debated with them,
24 whose standards should say it, that multiple barriers are
25 important.

1 We looked from afar at WIPP and we see no multiple
2 barriers. There is no waste processing, there is no waste
3 container. You have that difficulty. If we go to the
4 regulatory system that is the third delete or make guidance,
5 the make guidance part of it would presumably still have the
6 same or modified refined subsystem performance criteria and
7 it would have more flexibility than we have in the
8 regulation right now.

9 The regulation right now for each of them says
10 here is a rock, and if you got a better rock show it to us.
11 You are just changing a degree of flexibility. In either
12 case, line one or line three, you still have to face the
13 question of whether they are going to be 33 cent criteria or
14 50 cent criteria.

15 MR. STEINDLER: I understand that. The issue that
16 I am trying to address is first off, does that rock look
17 like the EPA rock. Two, does the EPA in fact say I have to
18 have rocks.

19 MR. BERNERO: I would say they do.

20 MR. STEINDLER: They probably do. The issue is,
21 what kind.

22 MR. BERNERO: Yes.

23 MR. STEINDLER: Dave.

24 MR. OKRENT: While Mr. Bernero is here and Mr.
25 Fehringer, the NRC has adopted permits below regulatory

1 concern, a somewhat controversial subject. It is my
2 impression that EPA has not objected to the concept but has
3 suggested that maybe a somewhat lower number would be
4 useful. Correct me if I am wrong.

5 In any event, what I recall hearing from I think
6 it was someone from EPA is that when they are trying to do
7 societal dose calculations for repository the individual
8 doses that they use are numbers far below the NRC's proposed
9 number for below regulatory concern or the EPA comment on
10 what might be a better number. In other words I heard that
11 I recall numbers in micro rem and so forth.

12 I would like to understand, is there any
13 relationship in the minds of the NRC staff between this
14 below regulatory concern regulation on the one hand and the
15 kind of arithmetic that goes into calculating the number
16 between one and 1,000 and 10,000 years depending on how you
17 look at it.

18 MR. BERNERO: First of all, in the dialogue with
19 EPA on below regulatory concern, the discussion were
20 confined to the low level waste arena as a practical matter.
21 In our agenda we started in the low level waste arena and
22 expanded it to be all practices. The Commission chose to go
23 for residues left by decommissioning, consumer products,
24 recycle and things like that.

25 There is a bit of a dichotomy. Nevertheless, I

1 think a simple way to put it is that EPA envisioned a BRC
2 value or dose value of four millirem per year to the
3 individual from all waste practices. That four millirem is
4 recognizable as the ever present drinking water criterion.

5 The NRC criterion does not exclude that, but the
6 use of one millirem per year to ten millirem per year,
7 depending on the breadth of practice and everything as
8 acceptable doesn't exclude and may not even be incompatible
9 with that. The difficulty one runs into in much lower
10 numbers -- what you called micro R per hour -- was very
11 clearly evident in the considerations for the Clean Air Act,
12 wherein the proposed rule for Clean Air Act -- EPA used the
13 RCRA type risk basis.

14 Now you are talking lifetime risk to an individual
15 from a substance released into the biosphere, and the RCRA
16 context has EPA looking at a range of risk -- ten minus four
17 to ten minus six lifetime risk -- with, as a matter of
18 policy, an EPA bias toward ten minus six per life. As a
19 result, if you look at the proposed rule for the Clean Air
20 Act you see it is ten millirem per year roughly down to .03
21 millirem per year. The dust off the parking lot will exceed
22 .03 millirem per year, so that is really not a usable or
23 practical standard.

24 EPA settled, and there is much debate about
25 implementation of it, on ten millirem per year. In this

1 case, I don't think there is a clear connection to that when
2 one looks at the health effects modeling in the high level
3 waste. I think this is much more like the radon emissions
4 from tailings piles and so forth. It gets more into the
5 integrated modeling over the whole population, the linear
6 downward extrapolation into the micro R range and the risk
7 coefficient significance of it.

8 It is very, very fuzzy. That is part of
9 assessing. If you look at the EPA standard as is presently
10 written for high level waste, it describes what I would call
11 a puff release. It is a very slow puff release where Delta
12 T is larger than a human lifetime, but it is a puff release.
13 The way that one relates that to population dose and
14 individual dose is very, very difficult to discern. It has
15 been related to population dose. I don't see any connection
16 to the BRC dialogue in it.

17 MR. OKRENT: In fact, it was someone from EPA who
18 asked Dr. Moeller, if you have any recommendations on where
19 we should cut off in calculating societal effects from high
20 level waste, tell us. I don't see why in fact below
21 regulatory concern is completely unrelated. That is just a
22 personal opinion.

23 MR. BERNERO: Excuse me, please. I tend to set
24 aside the integration cut off part of the BRC policy. You
25 are right, that is clearly relevant.

1 MR. STEINDLER: Are there any other questions or
2 issues?

3 MR. POMEROY: It is my impression that the amount
4 of dialogue between EPA and the NRC -- meaningful dialogue
5 in any case -- is not large. I see slight movement in the
6 EPA standard toward a little more deterministic, but I am
7 not aware of a great deal of dialogue. Over the past
8 several months there have been several suggestions that a
9 far more formal dialogue be initiated, namely a negotiated
10 rulemaking.

11 I think we have a letter in our file to the
12 technical review board essentially rejecting that approach
13 at this point in time. I wonder if you Bob, perhaps, since
14 your name is on my copy of the letter, if you could tell us
15 what the thinking was. I think I understand that because of
16 meeting with Chairman Carr. I wonder if you could tell us
17 what the thinking was in the rejection of that formal
18 mechanism at this time.

19 Secondly, whether or not you see a closer
20 interchange if there isn't such a close interchange now,
21 with EPA regarding how to perform this function.

22 MR. BERNERO: Let me remark on that. There has
23 been communication on this subject with Rich Geimand, with
24 Mike Shapiro who is the Deputy Assistant Administrator for
25 air and radiation. In starting, let me make it clear that

1 in our mind and in EPA's mind also, negotiated rulemaking
2 spelled with a capital letter on each word is a legal
3 formula. It has been used and will be used in future for
4 rulemaking. It is a formal mechanism, where basically all
5 the parties get to the table at once and lay their
6 contentions, arguments, and positions out and literally
7 negotiate a rule. Then there is a mechanism to promulgate
8 that rule.

9 Recognizing the iterative reactive character of
10 this and the high level waste standard and NRC's necessary
11 rulemaking for incorporation, for supplement or for
12 interpretation of that standard, one is driven to think of
13 another form of negotiated rulemaking. That might be
14 spelled with lower case letters. It is not the exact legal
15 formula of everybody sitting at one table on one rulemaking
16 and acting, but more like a negotiating process where the
17 parties come together in an iterative fashion in an open
18 technical exchange so that the informational development of
19 the rules by the responsible agency is what amounts to an
20 open covenant openly arrived at.

21 Our letter on negotiated rulemaking was addressing
22 the N and R and suggesting lean toward lower case negotiated
23 rulemaking. If you look at the EPA letters and look at the
24 current EPA activity which they haven't reached us yet --
25 the Conservancy Foundation -- they are looking at negotiated

1 rulemaking. I am fairly sure that it is negotiated
2 rulemaking more in the lower case sense.

3 There is regular dialogue between us and EPA
4 radiation standards. It is just over a week ago that I had
5 my last conversation with Rich Geimand. The difficulties
6 that inhibit substantive, very high rate of dialogue are
7 resources right now, particularly at EPA. They have had
8 some severe staffing difficulties, and they are trying to
9 cope with that. It has had a real impact on their ability
10 to maintain momentum on this work. We are trying to work
11 very carefully with them and develop a lower case negotiated
12 rulemaking activity.

13 MR. POMEROY: Is there a lack of resources in your
14 estimation, as the result of a lack of an assignment of a
15 high priority to this particular situation?

16 MR. BERNERO: I don't think so. I think it's a
17 body of circumstances that over time -- remember, they had a
18 big wave of activity on high level waste standards and then
19 went into a dormant period almost -- that is not a very
20 large group. They have had some very difficult losses in
21 personnel that make it very difficult to respond.

22 I know Geimand tells me his is working very hard
23 to get the right people, but you don't just go out in the
24 street and grab the first person that comes along and expect
25 them to get up and talk like Dan Fehringer does. I mean,

1 you just can't do that. You need experts. I think we are
2 blessed. We have some, but verbose, they may be.

3 MR. POMEROY: Thank you.

4 MR. STEINDLER: Looking at the clock, I think we
5 need a reality check. Let's quickly bring this thing to a
6 close.

7 MR. ORTH: I just wanted, among other things, to
8 commend the staff for something that Dan referred to a
9 couple of times that they have not done and then urge them
10 to continue not doing it. Specifically, Dan referred to the
11 fact that the NRC was trying to avoid being so what I will
12 call restrictive and proscriptive that you were actually
13 trying to design the facility for the DOE.

14 Having been in past and almost to the present
15 associated with various projects that I will not, for the
16 purpose of the transcript discuss, in which people at high
17 levels wanted to get very restrictive and proscriptive in
18 terms of what the design would look like, when they
19 themselves lacked any operating experience or construction
20 experience in the facility themselves. It turned out to be
21 unmitigated disasters when they were finally built and
22 people tried to operate them.

23 Unless the NRC has in its staff people with
24 experience, professional engineers in mining, geological
25 engineering, et cetera, as I said, I would commend you for

1 not doing it and urge you not to get too proscriptive.

2 MR. STEINDLER: Anything else? I want to thank
3 you for your patience and verboseness. I believe I can turn
4 this meeting back over to the Chairman -- we are only 55
5 minutes late.

6 MR. MOELLER: It has been a very productive
7 session and very helpful. We will take a 15 minute break.

8 [Whereupon, at 11:00 a.m., the transcribed portion
9 of the meeting concluded.]

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REPORTER'S CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission

in the matter of:

NAME OF PROCEEDING: 26th ACNW Meeting

DOCKET NUMBER:

PLACE OF PROCEEDING: Bethesda, Maryland

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Mary C. Larkin

Official Reporter
Ann Riley & Associates, Ltd.



PART 60 SUBSYSTEM PERFORMANCE OBJECTIVES

presented by

Daniel J. Fehringer
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December 12, 1990

HLW REGULATION CIRCA 1978

Basic Philosophy: Regs Should Match Rep. Design

- Reprocessing Wastes - 1,000 Year Problem
- No Waste Package Containment
- Glass Waste Form Being Questioned
- Site to Provide Waste Isolation



REVISED NRC STAFF VIEWS CIRCA 1979

Basic Philosophy: Design Should Meet Reg. Objectives
Staff Goal: Three-Way Redundancy

- 1,000 Year Containment By Canisters
- 1,000 Year Containment By Repository
- 1,000 Year Containment By Site



1980 ANPR

No Reprocessing -- 10,000 + Year Problem

Philosophy: Multiple Barriers with Min. Perf. Req.

- 1,000 Year Containment By Canisters
- 1,000 Year Containment By Underground Facility
- 1/100,000 Annual Release Rate After 1,000 Years
- 1,000 Year Radionuclide Travel Time
- No Correlation With EPA Standards



1981 PROPOSED RULE

Philosophy: Continued Multiple Barrier Requirement

- 1,000 Year Waste Package Containment
- 1/100,000 Annual Release Rate After 1,000 Years
- 1,000 Year Pre-Emplacement Groundwater Travel Time From Disturbed Zone to Environment
- No Correlation With EPA Standards



1983 FINAL RULE

Philosophy: Multiple Barriers, But Explicit Provision for
"Trade-Offs" Among Barriers

- 300-1,000 Year Waste Package Containment
- 1/100,000 Annual Release Rate After Containment
- 1,000 year Pre-Emplacement Groundwater Travel Time From Disturbed Zone to Environment
- Approval or Specification of Alternatives
- NUREG-0804 Shows More Likely to Meet EPA Standards, But Objectives Neither Necessary Nor Sufficient to Ensure Compliance



CURRENT STATUS

Continued Criticism By DOE and Technical Community
Reasons:

- Basic Regulatory Philosophy: Many Prefer
"Overall Systems" Approach
- Specific Wording of Performance Objectives



FUTURE EFFORTS

Continue Work to Improve Wording

- Substantially Complete Containment
- Pre-Emplacement Groundwater Travel Time
- Flexibility Provision



FUTURE EFFORTS (CONTINUED)

Continue With Iterative Performance Assessments

- Develop the Capability to Evaluate Both Individual Barrier and Overall System Performance
- Exercise the Capability for Yucca Mountain



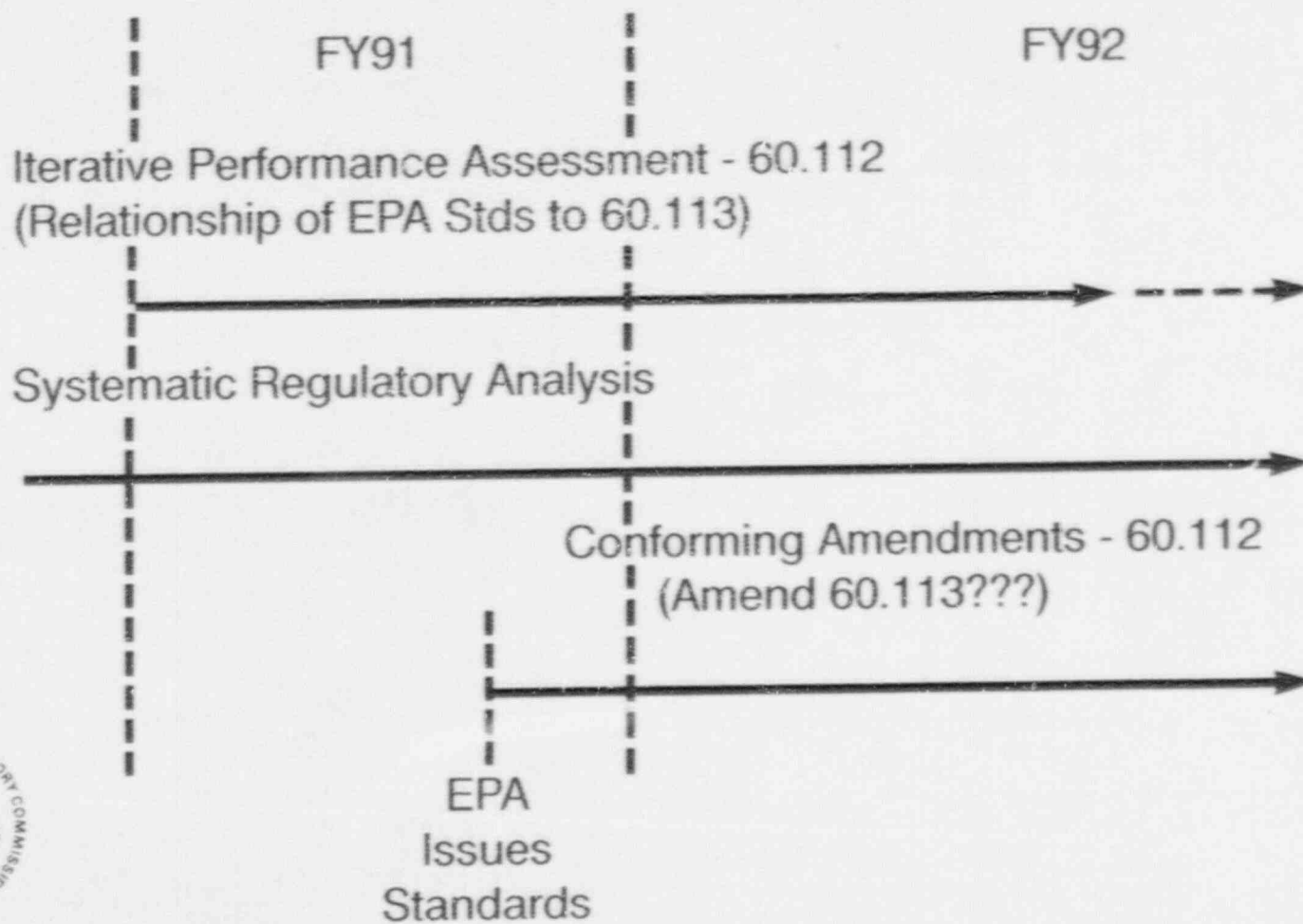
FUTURE EFFORTS (CONTINUED)

“Conforming Amendments”

- Adopt Applicable Parts of EPA Standards
- Reevaluate Relationship Between EPA Standards and Subsystem Performance Objectives
 - EPA's Release Limits Have Increased
 - New Ind. and Groundwater Protection Requirements
 - Other Changes May Occur, e.g., C-14 Limits



ACTIVITIES RELATED TO SUBSYSTEM OBJECTIVES



ALTERNATIVES FOR SUBSYSTEM OBJECTIVES

- Retain "Complementary" Objectives, But Fine-Tune Wording and Alternatives Provision
- Develop Objectives With a One-to-One Correspondence to EPA's HLW Standards
- Delete or Make Guidance

