

# UNITED STATES OF AMERICA NUCLEAR REGULATORY COMMISSION

Title: BRIEFING ON STATUS OF PART 100 RULE CHANGE AND  
PROPOSED UPDATE ON SOURCE TERM AND RELATED ISSUES

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NUCLEAR REGULATORY COMMISSION

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BRIEFING ON STATUS OF PART 100 RULE CHANGE AND  
PROPOSED UPDATE ON SOURCE TERM AND RELATED ISSUES

- - - -

PUBLIC MEETING

Nuclear Regulatory Commission  
One White Flint North  
Rockville, Maryland

Tuesday, August 3, 1993

The Commission met in open session,  
pursuant to notice, at 10:00 a.m., Ivan Selin,  
Chairman, presiding.

COMMISSIONERS PRESENT:

IVAN SELIN, Chairman of the Commission  
KENNETH C. ROGERS, Commissioner  
FORREST J. REMICK, Commissioner  
E. GAIL de PLANQUE, Commissioner

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## STAFF SEATED AT THE COMMISSION TABLE:

SAMUEL J. CHILK, Secretary

MARTIN MALSCH, Office of the General Counsel

JIM SNIEZEK, Deputy Executive Director for Nuclear  
Reactor Regulation, Region Operations and Research

ERIC BECKJORD, Director, Office of Research

THEMIS SPEIS, Deputy Director for Research

LEONARD SOFFER, Section Leader, DSIR, RES

ANDREW MURPHY, Chief, Structural & Seismic Engineering  
Branch, RES

FRANK CONGEL, Director, Division of Radiation Safety  
and Safeguards

FRANK MIRAGLIA, Deputy Director, Office of Nuclear  
Reactor Regulation

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

10:00 a.m.

CHAIRMAN SELIN: Good morning, ladies and gentlemen.

The Commission is pleased to welcome members of the staff to brief us on the status of the proposed update of the source term and the proposed revision to the reactor site criteria in 10 CFR Part 100.

These two proposed rulemakings are intended to decouple siting from plant design by a two step process. The first step is to modify Part 100 to address site criteria directly while moving the dose requirements currently in Part 100 to Part 50 on an interim basis. The second step is to update Part 50 to reflect current source term information and to replace the interim dose requirements with updated design criteria.

We were last briefed on these topics in April of last year. The staff subsequently has issued for public comment both a source term update and a proposed revision to Part 100. The source term update was issued for comment, this is a draft NUREG report, and the Part 100 revision was issued for comment as a proposed rule. Domestic and international comments

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1 have been received, quite extensive comments actually,  
2 and the staff is completing its analysis of these  
3 comments.

4 This morning the staff will brief the  
5 Commission on the status of these activities as well  
6 as on the remaining work to complete the decoupling of  
7 siting from plant design.

8 Copies of viewgraphs are available.

9 Just a word. This briefing is a little  
10 bit early in the process since the analysis isn't  
11 quite complete. But Mr. Sniezek, the Commission would  
12 appreciate an indication of the direction in which the  
13 staff is leaning and some idea of the current thinking  
14 at this point.

15 Commissioners, do we have any other  
16 opening comments?

17 COMMISSIONER de PLANQUE: No.

18 CHAIRMAN SELIN: Mr. Sniezek, you may  
19 proceed.

20 MR. SNIEZEK: Good morning, Mr. Chairman  
21 and Commissioners.

22 With me at the table this morning are, on  
23 my left, Themis Spies, Andy Murphy and Frank Miraglia,  
24 and on my right are Eric Beckjord, Len Soffer and  
25 Frank Congel.

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1           As you mentioned, a proposed rule to  
2       revise the Commission's reactor site criteria, 10 CFR  
3       Part 100, was issued for public comment October of  
4       last year. This proposed rulemaking has generated a  
5       great deal of interest both in the international and  
6       the United States communities. Consequently the  
7       comment period was extended twice and expired on June  
8       1st of this year.

9           The staff will summarize the major  
10       comments received and discuss our proposed future  
11       actions. In addition, the staff will also provide you  
12       with an update on accident source term issues and  
13       advanced notice of proposed rulemaking regarding  
14       severe accident performance requirements for future  
15       plants.

16           With that background, I'll now turn the  
17       presentation over to Doctor Speis.

18           DOCTOR SPEIS: Thank you, Mr. Sniezek.

19           Mr. Chairman, Commissioners, I have a  
20       slight cold, so I'm sure I will be able to overcome  
21       it.

22           We're here basically to update you and  
23       discuss with you the technical and policy issues that  
24       have been raised as a result of our proposals to  
25       update the source term. By that I mean bring it up to

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1 date technically, use today's technology, and of  
2 course the comments that we have received on the  
3 siting rule which includes both seismic and non-  
4 seismic aspects. As Mr. Sniezek said, we have gotten  
5 a substantial amount of comments and have generated,  
6 if I might say, some controversy both here and  
7 overseas.

8 Last, we'll talk to you about the other  
9 part of the effort which is to develop generic  
10 criteria for dealing with severe accidents for future  
11 ALWRs.

12 So, the briefing will cover these three  
13 issues.

14 (Slide) Next viewgraph, please.

15 As you see, the source term update, the  
16 draft report, the major comments that we have received  
17 that provoke the propose revision in the schedule.  
18 When we come to the Part 100, we'd like to spend quite  
19 a bit of time not only discussing the comments, but  
20 telling you some of the ideas that we have developed,  
21 what direction we plan to go.

22 (Slide) The next viewgraph, which is in  
23 color -- the next viewgraph, please?

24 CHAIRMAN SELIN: It looks a lot like you,  
25 Themis.

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1 DOCTOR SPEIS: Basically this repeats some  
2 of the things that, Mr. Chairman, you have said and  
3 Mr. Sniezek. The reason I put it there is to show  
4 that this whole effort is an integrated one and there  
5 is feedback from one activity to the other. The upper  
6 part shows the Part 100, the revision to it, which  
7 will pursue the idea of decoupling. That is the  
8 source term that is presently used for both design and  
9 siting purposes, will in the future be used only for  
10 design purposes and we will develop explicit criteria  
11 for siting. Meanwhile, we will put the source term  
12 into Part 50 to make sure that we have continuity for  
13 existing plants.

14 We come down to the revision of the source  
15 term itself and right at the bottom you see the  
16 initiation of the process to revise Part 50 to develop  
17 generic criteria for advanced plants. You see where  
18 they meet in the middle, where it says, "Proposed Part  
19 50 rule," where you have feeding -- two streams  
20 feeding into it, one the source term, the other one  
21 the severe accident. By that we mean that this is a  
22 complete severe accident rule where both source term  
23 insights will be utilized to develop criterion for  
24 engineering safety features and also the containment  
25 performance criteria to deal with the issue of severe

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1 accidents.

2 Basically what we're talking about is  
3 codifying some of the things that are being discussed  
4 now and you people have approved to be utilized in the  
5 certification for the advanced light water reactors.

6 The other comments I'd like to make is  
7 that the revised source term has not been proposed for  
8 backfitting on existing plants. However, it has been  
9 our intent that because the revised source term  
10 reflects our current understanding of course term  
11 behavior, licensees of existing plants may voluntarily  
12 propose changes to existing requirements using the  
13 revised source term in the future. Any such  
14 proposals, of course, would be reviewed on a case by  
15 case basis when this final NUREG which codifies our  
16 understanding of the source term becomes available.

17 As for future plants, as for the advanced  
18 light water reactors which we are presently reviewing,  
19 they have been told they can use the revised source  
20 term and, in fact, they have proposed their own, which  
21 Len will discuss shortly. That review by the staff  
22 will be done on a case by case basis and if the staff  
23 in NRR accepts any of those proposals, then they'll  
24 come to you and that also will be codified in the  
25 design certification process.

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1           As the Chairman said, we have been  
2 briefing you on this issue. Over the last two or  
3 three years we've provided to you a number of  
4 Commission papers. But the point I want to stress is  
5 that it's a very integrated and interrelated issue,  
6 the source term, severe accidents, all the rulemakings  
7 relating to it and we have been working very closely  
8 with the people in NRR.

9           Our next speaker, Len Soffer, is the focal  
10 point in the Office of Research and he will start the  
11 presentation. Later on Doctor Murphy, to my left,  
12 will address the seismic aspects of the revision.  
13 Also, I should have said that Len Soffer, who is the  
14 focal point in the Office of Research, has been  
15 working very closely with people in NRR working with  
16 Congel and Thadani in the back of me.

17           So, with that, I would like to ask Len to  
18 begin the briefing on the source term itself.

19           COMMISSIONER ROGERS: Could I just ask one  
20 question?

21           DOCTOR SPEIS: Yes.

22           COMMISSIONER ROGERS: You use the term  
23 "feedback" here and I don't see any feedback loops in  
24 the --

25           DOCTOR SPEIS: Well, actually --

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1 COMMISSIONER ROGERS: Well, let me just --  
2 before you --

3 DOCTOR SPEIS: Oh, I'm sorry.

4 COMMISSIONER ROGERS: They don't have to  
5 be here, but it started me thinking, and that is we  
6 see these streams coming together. But was there any  
7 feedback in the sense that as you look at this updated  
8 source term as it progressed, did that change in any  
9 way the severe accident criteria thinking? In other  
10 words, was there coupling between these streams that  
11 mutually influenced what ultimately came down to the  
12 box called proposed Part 50 rule? Were these two  
13 things coming together and then there they were  
14 totally independent and now to be folded together in  
15 Part 51 or during the evolution of considerations of  
16 each of these two streams was there any coupling --  
17 information coupling between them that led to perhaps  
18 a little change in what finally goes into that  
19 proposed Part 50 rule box?

20 DOCTOR SPEIS: Well, let me answer it in  
21 two ways. First of all, the source term and the  
22 severe accident showing at the bottom. They are  
23 coupled because source terms derive from severe  
24 accident. So, the likelihood of the sequences, it's  
25 an important consideration in deciding which ones to

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1 use and how to derive source terms from them. So, the  
2 feedback there is very strong between the two streams  
3 showing on the bottom here.

4 The insights from here also will go back  
5 into the loop and providing insights already on the  
6 exclusion area boundary and things of that sort. The  
7 feedback is there.

8 MR. SOFFER: I just wanted to add,  
9 Commissioner Rogers, that there is a coupling process  
10 that's going on right now. The proposed Part 50  
11 rulemaking is not yet mature. But as the source term  
12 has progressed, we have begun to see some implications  
13 of that upon the proposed Part 50 rule that are under  
14 discussion and development.

15 COMMISSIONER ROGERS: Well, I think that's  
16 very important because there's always the danger that  
17 we compartmentalize our work and then at the end we  
18 take two things and try to fit them together that  
19 might have been different if there'd been good  
20 communication earlier on. It's really a question  
21 that relates to process as much as results.

22 DOCTOR SPEIS: Len?

23 COMMISSIONER REMICK: Excuse me. Before  
24 proceeding, just a comment.

25 I realize we're not talking about the step

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1 2 in detail today, but this chart reminded me. Where  
2 you say replace the Part 50 dose criteria, I've said  
3 it before but it never hurts to say it again, that I  
4 hope that when you come to that we will see at least  
5 a consideration of whether doses can be established on  
6 a risk basis rather than deterministic as they exist.

7 The other thing is that the doses that are  
8 there, the 25 rem and the 300 rem -- 25 rem whole  
9 body, 300 rem thyroid, if that ratio is consistent  
10 with current ICRP recommendations, and in fact new  
11 Part 20 numbers for tissue weighting factors. So, I  
12 just hope that when the staff comes to that that they  
13 will address those points.

14 DOCTOR SPEIS: We are very mindful of  
15 that. In fact, the new source term contains  
16 additional nuclides that weren't there before that  
17 could have an effect on other organs besides the whole  
18 body. So, we appreciate that comment and we're very  
19 mindful of that.

20 MR. SOFFER: (Slide) I'd like to now  
21 discuss the source term update. Could I have  
22 viewgraph number 4, please?

23 As has been mentioned, the draft NUREG-  
24 1465 accident source terms for light water nuclear  
25 power plants was issued for comment in July of 1992.

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1 This is a report that is based upon a range of severe  
2 accident sequences that were studied in NUREG-1150 for  
3 current LWR plants. On the basis of that, there were  
4 two proposed source terms that were presented in the  
5 report as tabulations of release fractions versus time  
6 for a BWR and a PWR. They presented the various  
7 phases of a severe accident, including the gap  
8 activity release where fuel would be presumed to fail  
9 but the core geometry would remain intact, an early  
10 in-vessel release where fuel geometry is lost but the  
11 reactor pressure vessel itself has not failed. And  
12 finally, two phases that proceed after that involving  
13 ex-vessel releases from core concrete interactions and  
14 revaporization of nuclides from the primary coolant  
15 system.

16 The objective of this report was to  
17 provide a more realistic representation of a severe  
18 accident for design of plant mitigation systems. It  
19 was intended to represent the generalized progression  
20 of a severe accident, including pressure vessel  
21 failure, but it was never intended to represent any  
22 single accident sequence.

23 There were comments solicited from a group  
24 of experts that were internationally recognized to be  
25 working in this field and we have received 20

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1 individual comment letters from utilities,  
2 individuals, international and nationally recognized  
3 researchers.

4 In addition, the report presents release  
5 fractions that were based upon the mean estimates as  
6 presented in NUREG-1150 and a revised iodine chemical  
7 form based upon studies that were done by Oak Ridge  
8 National Laboratory.

9 (Slide) Could I have the next viewgraph?

10 The major comments that have been received  
11 on this report have been largely favorable. Most of  
12 the commenters have expressed their view that their  
13 revised source term incorporates severe accident  
14 insights and research and as such it represents a  
15 major advance over our existing TID-14844.  
16 Nevertheless there have been a number of suggestions  
17 for improvement. These include -- the key ones are  
18 that there is a belief that the early in-vessel  
19 releases particularly for the volatile nuclides,  
20 iodine and cesium, may be too low, while the ex-vessel  
21 releases may be too high.

22 There was a comment that the releases for  
23 the low volatile nuclides, that is nuclides such as  
24 barium, strontium, cerium, lanthanum, and ruthenium,  
25 both in-vessel and ex-vessel, may be too high.

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1 COMMISSIONER REMICK: Len, on that, if I  
2 recall from a previous briefing, there was something  
3 like a factor of ten between staff and EPRI results.

4 MR. SOFFER: That's correct. I think in  
5 some cases it may even be more than a factor of ten,  
6 but that's my recollection.

7 COMMISSIONER ROGERS: A factor of 1,000 in  
8 cerium, yes.

9 COMMISSIONER REMICK: Has there been any  
10 closing of that gap?

11 MR. SOFFER: We believe that we will  
12 probably narrow that gap. EPRI and industry sources  
13 have presented us with some later analyses that we  
14 believe may narrow that gap. I'm not sure that it  
15 will be complete agreement, but I think it will be  
16 closer.

17 MR. MIRAGLIA: If the Commission may  
18 recall is that in the review of the EPRI document we  
19 indicated that we would use 1465 unless the vendor  
20 would propose something different. In terms of the  
21 ABWR, they used the traditional TID source term.  
22 System 80 is using 1465. The passive plants are using  
23 things more in line with the EPRI guidelines. So,  
24 those matters were under review and the issues --  
25 there are issues, even for System 80. But we are

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1 making progress in those areas.

2 COMMISSIONER REMICK: Thank you.

3 MR. SOFFER: Additional comments were that  
4 the release fractions for the gap release phase were  
5 too high. There was a comment that iodine chemistry  
6 is very complex and is a very dynamic process and that  
7 one should be very careful about specifying iodine in  
8 chemical form.

9 EPRI had a comment that they felt that dry  
10 cavity releases were inappropriate for ALWRs and that  
11 the ex-vessel releases therefore should not appear at  
12 all. Finally there was a generalized comment that the  
13 removal mechanisms needed better treatment and we'll  
14 recognize that.

15 (Slide) I just wanted to, on the next  
16 viewgraph, present the tabulations and I've shown them  
17 only for a PWR. Viewgraph number 6 shows the values  
18 as they appear in draft NUREG-1465 and I want to  
19 emphasize that because of the comments and the  
20 additional analyses that these are not final values,  
21 that there probably will be some changes. I wanted to  
22 show the various release phases, the durations and the  
23 release fractions. To emphasize, for example, that in  
24 the column that is shown as ex-vessel, the values  
25 shown are for a dry reactor cavity and the staff has

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1 always taken the position that where water is  
2 available in the cavity, that water would certainly  
3 scrub any fission products that are released.

4 (Slide) In viewgraph number 7, I want to  
5 show for comparison the PWR releases that are in the  
6 EPRI passive plant. EPRI has combined the gap -- has  
7 not specifically separated out the gap release phase  
8 and it's combined with the early in-vessel releases.  
9 EPRI has taken the position that because of water in  
10 the reactor cavity they believe that the debris would  
11 be sufficiently cooled that there would be essentially  
12 no ex-vessel releases.

13 (Slide) If we can go on to viewgraph  
14 number 8, we are in the process of finalizing --

15 COMMISSIONER ROGERS: Just coming back  
16 just for a second.

17 MR. SOFFER: Yes.

18 COMMISSIONER ROGERS: I didn't quite  
19 realize the distinction between what the entries in  
20 that table meant with respect to gap release in ex-  
21 vessel. I thought they just didn't analyze them. But  
22 you're saying that they didn't analyze the gap  
23 release. Is that --

24 MR. SOFFER: They didn't separate them out  
25 specifically.

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1 COMMISSIONER ROGERS: Didn't separate that  
2 out separately, but as far as ex-vessel their numbers  
3 would be essentially zero.

4 MR. SOFFER: That's correct. They believe  
5 that --

6 COMMISSIONER ROGERS: You know, it would  
7 be helpful when you make a table like that to show  
8 that because that's a different conclusion that one  
9 comes to. It looks just as if they didn't do it or  
10 didn't report on it. But they have a conclusion for  
11 ex-vessel.

12 MR. SOFFER: That's true.

13 COMMISSIONER ROGERS: I see.

14 DOCTOR SPEIS: Based on the scenarios that  
15 they have considered.

16 COMMISSIONER ROGERS: Yes.

17 MR. SOFFER: (Slide) If we could turn to  
18 viewgraph number 8.

19 We're in the process of finalizing NUREG-  
20 1465. We're responding to the comments and the  
21 comments, as I say, have been for the most part very  
22 thoughtful. Excellent comments and we're indebted to  
23 the thoughtful analysis that has gone into most of  
24 them.

25 We are going to be incorporating improved

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1 insights from removal mechanisms. We've had  
2 additional contractor studies looking at the effect of  
3 water overlying core debris, on improved spray  
4 modeling and removal of aerosols, on natural aerosol  
5 deposition on the effects of suppression pools and we  
6 want to try and incorporate the results of these  
7 studies into the final version.

8 COMMISSIONER REMICK: Len, what were in  
9 general the results of looking at the spray removal  
10 coefficient? Any conclusions drawn on that one?

11 MR. SOFFER: The general conclusion that  
12 we've gotten from the contractor studies is that  
13 sprays are quite effective at removal of containment  
14 aerosols and we believe that the current models that  
15 are represented in the staff standard review plan are  
16 probably a little conservative.

17 The final source term report is expected  
18 to incorporate the comments dealing with things like  
19 in-vessel releases for volatile and non-volatile  
20 nuclides, as well as gap release fractions. We do  
21 plan to retain explicit consideration of ex-vessel  
22 releases, but the implementation of that is still  
23 being worked on within the staff. Final NUREG-1465 is  
24 expected to be issued at the end of 1993.

25 I'd like to turn now to discuss the non-

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1 seismic aspects of the revision of Part 100.

2 (Slide) Could I have viewgraph number 10,  
3 please?

4 In talking a little bit about the reactor  
5 site criteria, just a little bit of background. The  
6 present rule, as I'm sure you're all aware, involves  
7 a fission product release essentially that of TID-  
8 14844 that has postulated into the containment and  
9 doses are evaluated for individuals at the exclusion  
10 area boundary and LPZ outer radius.

11 Part 100 itself is quite flexible because  
12 of the dose calculation and it has no numeric criteria  
13 for the exclusion area boundary and the LPZ sizes.  
14 That is, it's controlled by the source term and dose  
15 calculations and the credit given for engineered  
16 safety features, containment leak rate, et cetera.  
17 Reg Guide 4.7 that was issued in 1975 provides  
18 guidance on the population density within 30 miles  
19 from the reactor.

20 The proposed rule proposed to delete  
21 source terms and dose criteria for site evaluation  
22 purposes. They were moved on an interim basis to  
23 50.34 for plant evaluation. The proposed rule  
24 specified a minimum exclusion area size of 0.4 miles  
25 and population density of 500 persons per square mile

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1 out to 30 miles. The population density criteria was  
2 not an upper limit of acceptability, but was a trigger  
3 value that triggered a requirement for a justification  
4 of alternative sites.

5 In addition, the proposed rule had a  
6 requirement that the physical characteristics that  
7 could pose significant impediment to the development  
8 of emergency plans be identified and that evaluation  
9 of man-related hazards was required.

10 COMMISSIONER REMICK: Len, what was the  
11 technical basis of selecting the four-tenths of a mile  
12 and the 30 miles, realizing the 30 miles was some time  
13 ago?

14 MR. SOFFER: The technical basis for the  
15 four-tenths of a mile was that it was believed to be  
16 that distance which when used with the source term,  
17 the TID source term that is, and a relatively  
18 conservative evaluation of engineered safety features,  
19 that was a distance that would likely be able -- where  
20 an applicant would likely be able to meet the Part 100  
21 doses.

22 COMMISSIONER ROGERS: But then why was  
23 that unaffected by the new source term results?

24 MR. SOFFER: At that time it wasn't clear  
25 what the new source term -- quite what the new source

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1 term was going to look like and that was a number that  
2 people felt relatively comfortable with.

3 COMMISSIONER ROGERS: Yes, but we're at  
4 this time now, not that time.

5 MR. SOFFER: We may be getting ahead of  
6 the story a little.

7 COMMISSIONER ROGERS: Okay.

8 DOCTOR SPEIS: We'll discuss some options  
9 for --

10 COMMISSIONER de PLANQUE: Are you going to  
11 return to this? Okay.

12 DOCTOR SPEIS: Yes. Okay.

13 MR. SOFFER: Yes.

14 (Slide) Could we go to viewgraph number  
15 11?

16 Mr. Sniezek has already pointed out,  
17 covered out when the proposed rule was issued and when  
18 the proposed rule expired. I wanted to mention that  
19 we received over 80 comment letters from this rule,  
20 for this rule.

21 CHAIRMAN SELIN: If you add any comments  
22 that the Commissioners received, it gets about 300.  
23 There's a lot of interest in it.

24 COMMISSIONER de PLANQUE: If you include  
25 the oral ones, it was ten times more.

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1 MR. SOFFER: (Slide) Could we go to  
2 viewgraph number 12?

3 We are still in the process of finalizing  
4 our analysis of the public comments, so these  
5 represent what we believe are the gist of the comments  
6 received, but they're by no means an exhaustive  
7 listing.

8 Viewgraph number 12 summarizes the key  
9 comments that we received from the international  
10 community. The major comment was that there was a  
11 rather overwhelming opinion that siting should not be  
12 decoupled from design. The respondents felt that this  
13 was a logical and a consistent way of choosing  
14 exclusion area distances and they were not sure why  
15 one would want to change this and what the reasons for  
16 it were. Furthermore, they felt that the exclusion  
17 area distance that was chosen, the four-tenths of a  
18 mile, was too restrictive, that it was too large, and  
19 that there seemed to be a poorly defined or not much  
20 of a technical basis for that.

21 There were also some strong comments that  
22 population density criteria themselves should not be  
23 in the regulations and that they were quite  
24 restrictive. There were comments from a number of  
25 countries in the Far East, Korea, Japan and Taiwan

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1 that "they would not be able to comply." Now, we  
2 recognize that -- and I think these countries  
3 recognize that there is no legal requirement for them  
4 to comply. But I think that we were not fully aware  
5 of the prominence of NRC regulations throughout the  
6 world and the deference that other people give to such  
7 regulations. When they said that they wouldn't be  
8 able to -- Doctor Congel and I were at an  
9 international meeting and we heard the same gist of  
10 comments and we said, "You don't have to comply," and  
11 they said, "But you don't understand. We feel kind of  
12 strongly obligated to do so." The feeling was that  
13 Regulatory Guide 4.7 has worked and continues to work  
14 sufficiently well.

15 And there was also comments that the rule,  
16 for example as expressed by Taiwan, was that it would  
17 have a great impact on nuclear development and yet  
18 would have no significant safety enhancement.

19 COMMISSIONER REMICK: Len, were there any  
20 comments from Europe on population density? You  
21 mentioned the Far East.

22 MR. SOFFER: There were similar comments.  
23 I believe that a number of the Far Eastern countries  
24 felt particularly aggrieved by this.

25 (Slide) Going on to viewgraph number 13.

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1           Some of the comments expressed by the  
2           industry and they were similar to the international  
3           comments and I'm not repeating the same ones, but  
4           again there was a strong comment about not codifying  
5           Regulatory Guide 4.7 and not putting numerical  
6           population density in the regulations, that this was  
7           believed to be too restrictive.

8           There were also strong comments from  
9           environmental groups and members of the public.  
10          Generally these were that the proposed rule, they  
11          felt, did not consider future population growth, that  
12          population density should be specified out to 50 miles  
13          rather than 30 miles, that an exclusion area of 0.4  
14          miles is too small. There were comments made that  
15          states should have veto on siting on new nuclear power  
16          plants. There was comments that the NRC was reducing  
17          the exclusion area and should not do so. There were  
18          comments that the rule would allow plants near higher  
19          populations. Comments were made that the 1979 siting  
20          policy task force recommendations should be made more  
21          stringent and then adopted. Finally, there were  
22          comments that those plants that could not meet the  
23          four-tenths of a mile exclusion area boundary should  
24          be shut down.

25                   COMMISSIONER ROGERS:     Were there any

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1 technical arguments advanced in support of some of  
2 these comments? I mean the exclusion area is too  
3 small because, with a technical basis or --

4 MR. SOFFER: The major technical basis was  
5 expressed by some of them that the exclusion boundary  
6 should provide a guarantee of safety even for severe  
7 accidents involving core melt and containment failure,  
8 for example. That is that it should provide a very,  
9 very high level even in the event of catastrophic  
10 accidents.

11 CHAIRMAN SELIN: Mr. Soffer, let's go back  
12 to the April 1992 briefing for a moment.

13 MR. SOFFER: Yes.

14 CHAIRMAN SELIN: I'm relatively new to  
15 these rather arcane arguments and it's pretty clear  
16 why -- at least to me from a defense in depth concept  
17 why we would like to decouple the siting criteria from  
18 the design criteria. But it's not clear to me why we  
19 want to decouple the source term from the siting  
20 criteria. It seems to me that the source term and the  
21 siting criteria would be very tightly coupled. I can  
22 see why bureaucratically we want them in separate  
23 parts of the code, but not why they shouldn't be tied  
24 together. Am I misunderstanding this?

25 MR. SOFFER: I'm not sure I understand

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1       that --

2                   CHAIRMAN SELIN: Well, we're putting the  
3       source term in the related Part 50 and we're putting  
4       the siting criteria in Part 100. Do we have the  
5       mechanism to keep them together such that if a new  
6       design resulted in less of a source term or a new  
7       analysis resulted in less of a source term that the  
8       siting criteria would change?

9                   MR. MIRAGLIA: I think it's because of  
10      that question, Mr. Chairman, that the staff examined  
11      that. Given the present rules, having the dose and  
12      the siting coupled together, and one then trades of  
13      siting decisions versus design decisions. So, the  
14      primary emphasis was to try to separate, make siting  
15      decisions from siting perspectives, performance and  
16      siting parameters and tying the design in led to those  
17      kinds of tradeoffs and that was the reason for trying  
18      to --

19                  CHAIRMAN SELIN: I see. Maybe I didn't --

20                  COMMISSIONER de PLANQUE: Doesn't this get  
21      back to Commissioner Rogers' question which source  
22      term do you use in coming up with these numbers?

23                  CHAIRMAN SELIN: Well, let me just follow  
24      up on this a little bit. One thing I've always  
25      objected to -- always objected -- it hasn't been that

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1 long, but I've objected to is the concept that if you  
2 want to put a reactor in a highly populated area you  
3 can put in a double containment or something like  
4 that. That seems counter intuitive. If you know how  
5 to design a better reactor and it's reasonably  
6 approved, you should put it in. But the other way  
7 around, which is if the next generation of reactors  
8 comes up with some further improvement, not because  
9 you did a specific design that you know, but that you  
10 get into some new technology or some new approach  
11 which further reduces the likely dose, shouldn't that  
12 be coupled to the siting criteria? Wouldn't one  
13 permit smaller exclusion area zones and if such an  
14 item happen or is that a poor idea?

15 MR. MIRAGLIA: Well, I think, as you said,  
16 going to double containment, it's more than just  
17 source term. One has to say, "What's the source term,  
18 what are the release fractions, what's the timing,  
19 what's containment performance?" You can, if you --  
20 with continued improvements in source term technology  
21 make an argument that you need no exclusion area and  
22 was trying to reach that balance and examine that kind  
23 of question in saying defense in depth does indicate  
24 that there is some consideration as to where we should  
25 put some plants in terms of remoteness to population

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1 and things like that. We're trying to decouple that.  
2 The numbers that were articulated is looking at the  
3 array of the 100 plus plants that we've licensed to  
4 say, "What has the application of those rules done in  
5 terms of siting a plant if we come up with something  
6 consistent with the decoupling of the source term?"  
7 I think that's the general rationalization as to why  
8 we attempted this type of process. But these comments  
9 have raised that as an issue again. That needs to be  
10 looked at and examined again.

11 CHAIRMAN SELIN: Good answer.

12 MR. SNIEZEK: Mr. Chairman, I think, if I  
13 understand the point you're driving at, if you're  
14 looking at a consistent level of public safety from  
15 site to site, it's exactly right, there is a tradeoff.

16 CHAIRMAN SELIN: Let me make it clear.  
17 I'm not in favor of saying, you build a pretty good  
18 reactor if it's going to be in the country and you  
19 build a better reactor if you come into close -- I'm  
20 not talking about from a given generation differences  
21 from site to site. The whole concept of the design in  
22 depth says you don't rely on any one piece to make up  
23 for other shortcomings if you have the choice. I'm  
24 talking about more of a generational view. As you go  
25 from evolutionary reactors to passive reactors or to

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1 some other technology, do you feel strongly that one  
2 should not have to reexamine the exclusion criteria,  
3 et cetera?

4 You may be getting into this a little  
5 later. I'm pleased to wait for that. It's one thing  
6 to say we're going to have a design, a defense in  
7 depth concept with sort of a given level of technology  
8 and another to say that we really will decouple areas  
9 that are clearly related in terms of technological  
10 advancement as opposed to extra compensation in  
11 design. I'd be interested in how you feel about that  
12 at the appropriate time.

13 DOCTOR SPEIS: If I may say something, Mr.  
14 Chairman. One of the things that drives risk is  
15 severe accidents.

16 CHAIRMAN SELIN: Right.

17 DOCTOR SPEIS: The present generation of  
18 reactors, the containment is always assumed not to  
19 fail. It's a leak-type containment, like .1 percent,  
20 one per day. So, it is never assumed to fail. Now,  
21 for future plants, as Frank said, because of insights  
22 that we have gained over the last ten years about the  
23 importance of severe accidents, we're coming up with  
24 containment performance requirements. So, that plus  
25 the source term and looking at the risk profile of

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1 those plants, which already will have a robust  
2 containment to accommodate challenge from severe  
3 accidents, there is no question that from the  
4 technology you can take those plants closer and closer  
5 to the city. So, it becomes, I guess, a policy  
6 question. But from a risk standpoint, at least some  
7 of us feel confident that future plants will pose very  
8 little risk.

9 Maybe there are others -- I guess there --  
10 not maybe. There are, of course, other considerations  
11 in coming up with an EAB that maybe Frank Congel can  
12 articulate. There are security issues, there are --

13 COMMISSIONER de PLANQUE: Emergency  
14 preparedness.

15 MR. SNIEZEK: I don't believe from the  
16 staff viewpoint we've really developed a consensus on  
17 this point whatsoever. We've got different views on  
18 it, but it's really premature to speak from our side  
19 of the table intelligently on that point at this time,  
20 I believe.

21 COMMISSIONER ROGERS: Well, could I just  
22 make a comment because it was something that Frank  
23 Miraglia said that bothered me a little bit in the  
24 sense that if you just look at the present generation  
25 of plants and the siting criteria that might evolve

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1 from just looking at what has happened there, and  
2 using that as a guide for the future, it really  
3 ignores the technological questions and these are  
4 demographic questions and things of this sort that we  
5 might be very comfortable with but are not necessarily  
6 indicative of anything.

7 MR. MIRAGLIA: I didn't mean to say that  
8 that was the dispositive determination --

9 COMMISSIONER ROGERS: Well, if I could  
10 just finish.

11 MR. MIRAGLIA: It was a consideration.

12 COMMISSIONER ROGERS: I understand. All  
13 the recommendations aren't in yet. But I'm just  
14 saying that it seems to me that one has to be very  
15 careful about that because I think we ought to try  
16 to -- if we're going to talk about a rule, that we  
17 ought to have as sound a technical basis for that as  
18 possible. Looking at just history doesn't give you a  
19 technical basis, it gives you a history. It may be  
20 that in this country it's always been easy for us to  
21 put plants in remote sites. That may be fine. I  
22 certainly don't see anything wrong with that and to  
23 even encourage it. But if we put it in a rule,  
24 implying that that's necessary for protection of  
25 public health and safety, then that's a different

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1 matter.

2 So, I'm just saying I think one has to be  
3 careful about looking at the existing situation as a  
4 reasonable basis for a rule change when we have new  
5 technical data to influence that.

6 MR. MIRAGLIA: I think the staff would  
7 agree. I would certainly agree with that,  
8 Commissioner Rogers. I think it was a point of  
9 departure, as Doctor Speis said. In addition to those  
10 things, one has to consider containment performance,  
11 severe accidents and those kinds of uncertainties.  
12 That's how the judgment was reached, an engineering  
13 judgment to come up with these kinds of proposals.  
14 These are what's being questioned by some of the  
15 comments. We'll go back and reexamine that. But  
16 certainly if I left you the impression that we're just  
17 going to do it because history has served us well, I  
18 don't want to leave you with that impression.

19 CHAIRMAN SELIN: Mr. Beckjord?

20 MR. BECKJORD: It seems to me that if you  
21 look at the recent work on the source term that what  
22 it shows comparing the present view with the TID, the  
23 releases aren't all that much. I mean the change in  
24 release is not that much. What is different is the  
25 timing and the releases taking place at slower rates.

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1 So, that has an important but not a decisive effect.

2 I think if a future technology were to  
3 show a substantially smaller source term that your  
4 point is well taken, that you would then -- it would  
5 be very important to look at the siting.

6 CHAIRMAN SELIN: My point is less than it  
7 appears. My point is consistent with Commissioner  
8 Rogers. It is that we ought to just be very careful  
9 about what is prescriptive and then what are put in a  
10 statement of considerations, that there are certain  
11 things under no conditions that we will compromise on.  
12 But just because we set an exclusion area distance or  
13 a low density distance of a certain amount that would  
14 be, I assume, relatively small numbers, then we would  
15 have a statement of consideration to say yes. But  
16 you'd have to have an awfully good reason to put a  
17 plant in a suburb that you could otherwise put  
18 outside.

19 But revolutionary as it may be, maybe we  
20 ought to hear what Mr. Soffer says you're actually  
21 going to do before we tell you whether we like it or  
22 not.

23 COMMISSIONER REMICK: Just one thing I'd  
24 like to add at this point of conversation. That is,  
25 if you recall, the Agency started out on a siting rule

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1 a decade or so ago and at that time Europe was very  
2 concerned about what the Agency might do. So, the  
3 Commission decided to hold off on the siting rule  
4 until they developed a safety goal to get some kind of  
5 a risk perspective. One of the things that I find  
6 missing, I see no mention in your analysis here and  
7 discussion of how safety goal might fit in to such  
8 considerations. That surprised me inasmuch as the  
9 Commission decided, "Let's get a safety goal first  
10 before we pursue a siting rule." I admit that was a  
11 decade or so ago, but that was how things happened as  
12 I recall.

13 MR. SOFFER: We did look at the safety  
14 goal and we did examine the proposed criteria in  
15 regard to the safety goal.

16 As far as looking at a proposed exclusion  
17 area, we found that the quantitative health objective  
18 of the safety goal could be met for exclusion area  
19 sizes significantly smaller than .4 miles.

20 COMMISSIONER REMICK: Wouldn't that have  
21 been appropriate to discuss it in --

22 MR. SOFFER: I believe we did discuss it  
23 at the April meeting and at the time we presented the  
24 proposed rule to the Commission. We looked at a range  
25 of exclusion area sizes from about a quarter of a mile

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1 up over a half a mile and we found that the safety  
2 goal, the individual quantitative health objectives,  
3 were met for even the smallest exclusion area distance  
4 that we looked at, which was a quarter of a mile.

5 COMMISSIONER REMICK: I understand, but  
6 the point is, if the answer isn't what we want, do we  
7 just dispose of it and proceed? I'm not saying the  
8 safety goal should be dispositive, but I do think it  
9 should have entered into the considerations in as much  
10 as the Commission had decided let's hold off until we  
11 get a safety goal and give us some kind of  
12 perspective.

13 Proceed.

14 MR. SOFFER: Okay.

15 (Slide) Can we turn to viewgraph number  
16 14?

17 At the present time, I'd say that there  
18 are a number of problems with the proposed rule that  
19 the staff recognizes.

20 Number one, the value for the exclusion  
21 area boundary of 0.4 miles was based on the TID source  
22 term, not on a revised source term, and it was based  
23 on a conservative evaluation of engineered safety  
24 features. Furthermore, as Commissioner Remick points  
25 out, the Commission safety goal would permit a smaller

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1 value and a revised source term would also permit a  
2 smaller value, and so this is one of the things that  
3 we are looking at.

4 The second bullet reflects the discussion  
5 that we had a few moments ago, that is that these are  
6 intended to be siting criteria for future reactors and  
7 as such they may not recognize the improvements that  
8 have been made in reactor safety.

9 And third, we recognize that issuing firm  
10 numbers in a rule implies a greater importance than  
11 may be warranted and provides no real flexibility.  
12 The staff did look at a number of sites that had  
13 exclusion area distances less than four-tenths of a  
14 mile and believed that these were reasonable good  
15 sites and consequently we have -- we certainly did not  
16 mean to imply that there is a problem or there is a  
17 real safety concern at less than four-tenths of a  
18 mile.

19 (Slide) Going on to number 15, future  
20 actions are that we are completing an evaluation of  
21 comments. We have not completed them as yet and we  
22 are proposing to send the final rule to the Commission  
23 in February of 1994 after discussions with the  
24 Advisory Committee on Reactor Safeguards and the  
25 Committee to Review Generic Requirements.

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1                   We are considering a number of  
2 alternatives, one of which is, and I'm stating only  
3 one of the alternatives at this point, one of them  
4 might be to state general objectives for an exclusion  
5 area and population density in the rule and to put the  
6 population densities -- have them remain in a  
7 regulatory guide such as 4.7.

8                   There may be a number of other  
9 considerations. I don't know if Doctor Speis wanted  
10 to mention the others or --

11                   DOCTOR SPEIS: Can we discuss them at this  
12 time, Mr. Chairman?

13                   CHAIRMAN SELIN: Yes.

14                   DOCTOR SPEIS: I have listed here about  
15 four additional ones in addition to the one that Len  
16 just mentioned. These have been discussed amongst  
17 some of us. They haven't been thoroughly aired out  
18 yet. We haven't put out all the pros and cons.

19                   Of course one of them is to just retain  
20 the present Part 100 with TID source term and the reg  
21 guide as is, just go back where we were. We got so  
22 many different comments and some of them are  
23 conflicting, so maybe we give up and go back to things  
24 as they were.

25                   COMMISSIONER REMICK: With the same TID

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1 source term, did you say?

2 DOCTOR SPEIS: Yes, that's one option.

3 CHAIRMAN SELIN: Don't be easily -- if  
4 that's just to get the Commission to say, "No, no,  
5 keep going forward," you have succeeded, Doctor Speis.

6 DOCTOR SPEIS: The next option is to  
7 retain Part 100 as is, that is use the source term for  
8 both siting and design, but use a revised source term  
9 and also use Reg Guide 4.7. Of course, this is a  
10 familiar process. The site-specific evaluation of  
11 radiological consequences is always an important risk  
12 communicator to the public because you're using the  
13 source term. Based on that, you're deriving criteria.  
14 It requires minor changes to Part 100.

15 The only thing we have to look carefully  
16 is, since the new source term contains additional  
17 nuclides, some of them different than iodine, we have  
18 to take a good look at the dose criteria, the whole  
19 body and the thyroid, to make sure that the other  
20 organs are not affected from the cesium or the  
21 strontium or the other ones that are present in the  
22 new source term.

23 COMMISSIONER REMICK: Although, am I  
24 correct, if we use effective dose equivalent like in  
25 Part 20 for those doses, that would automatically be

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1 taken care of, automatically considered?

2 DOCTOR SPEIS: Frank, can you address  
3 that?

4 MR. CONGEL: Yes. If we choose to go that  
5 way, that's correct, yes. That was something we  
6 planned to update in any case regardless of how this  
7 comes out.

8 COMMISSIONER REMICK: I would hope so.  
9 That's part of my emphasis. When we change those  
10 doses, we look at what is in Part 20, what's ICRP  
11 saying and so forth.

12 DOCTOR SPEIS: As I said, there are two  
13 aspects of the source term. One is to come up with  
14 the siting criteria. The other one is to evaluate the  
15 design. Okay? And there are a number of features  
16 that are involved, engineering safety features,  
17 filters, sprays, equipment qualification.

18 Now, if we give realistic credit to the  
19 engineering safety features, we'll probably come up  
20 with EABs that are very small, even lower than .2  
21 possibly. So that will be one of the things that all  
22 of us have to know what it means. Of course it will  
23 have to go in revised Reg Guides 1.3 and 1.4 which  
24 describe the details, how you do these evaluations.  
25 So then, this option only discusses the leave things

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1 as they are but use the revised source term.

2 The next option is what we have on the  
3 street right now, and let's not talk about that.

4 Another option will be to use the rule  
5 that we have put out, but to change the EAB to .25  
6 miles instead of .4, and still leave the numbers in  
7 the rule itself versus the Reg Guide 4.7. If we use  
8 the realistic source term and if we use appropriate  
9 credit, scientifically justified credit with  
10 engineering safety features, we think we can justify  
11 the .25 exclusion area boundary.

12 COMMISSIONER REMICK: Just a question on  
13 that.

14 DOCTOR SPEIS: Yes?

15 COMMISSIONER REMICK: When we consider  
16 what we are doing in Part 73, perhaps Part 73 will  
17 define an EAB that maybe is consistent with this.

18 MR. CONGEL: That's one of the thoughts  
19 that we're pursuing now. We're looking into that,  
20 yes.

21 COMMISSIONER REMICK: Good.

22 DOCTOR SPEIS: I would like to make this  
23 point, because -- I made it earlier and it's very  
24 important, because Len said that the .4 exclusion area  
25 boundary has been based on a conservative source term

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1 and not giving appropriate credit to the engineering  
2 safety features. If you do that, then .4  
3 approximately meets the existing dose guidelines.

4 I just said that, if we use the realistic  
5 source term and realistic credit for engineering  
6 safety features, then we can justify .25. But in both  
7 cases, we are assuming that the containment stays  
8 intact. Okay? And it leaks at the design rate or  
9 close by, which is .1 volume percent per day, so that  
10 means, you know, we're kind of schizophrenic because  
11 we're not considering the full aspects of a severe  
12 accident.

13 The people who put this process together  
14 thought about severe accidents, but they only used the  
15 radioactive part, the source term, but they didn't  
16 include the forces associated with severe accident,  
17 the challenges, you know, the pressures and  
18 temperatures. But for future plants, of course, we're  
19 coming up with containment performance criteria, so  
20 that will kind of complete the picture, and that's a  
21 very important consideration to think when we're  
22 talking about boundaries that meet source terms.  
23 We're assuming an intact containment that leaks at the  
24 design basis leak.

25 Yes, Mr. Chairman. I'm sorry. I wanted

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1 to complete my thought.

2 CHAIRMAN SELIN: I'm glad you completed  
3 your thought. You more or less answered the question  
4 that I was going to ask you.

5 DOCTOR SPEIS: Okay.

6 COMMISSIONER REMICK: I would just say,  
7 Themis, that's where risk perspective is helpful.

8 DOCTOR SPEIS: Yes, it's very important.

9 COMMISSIONER REMICK: Otherwise, you draw  
10 conclusions on potential consequences.

11 DOCTOR SPEIS: That's right.

12 MR. MAYFIELD: Mr. Chairman, could I add  
13 something here? I just wanted to point out that what  
14 we've described here is staff practice in implementing  
15 Part 100. In fact, Part 100 by its terms requires an  
16 evaluation of doses at the exclusion area boundary and  
17 low population zone boundary from any accident  
18 considered credible. And defining what is a credible  
19 accident, while it's well-defined in staff practice,  
20 has been in the past an enormous source of litigation  
21 on a case by case basis. So, if we were to leave the  
22 regulation intact, we would be involved in future  
23 rounds of litigation as to what's meant by a credible  
24 accident.

25 CHAIRMAN SELIN: Failure of a containment

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1 would clearly be not incredible, right?

2 MR. MAYFIELD: It's been considered  
3 incredible in past practice.

4 CHAIRMAN SELIN: Incredible?

5 MR. MAYFIELD: Incredible.

6 DOCTOR SPEIS: Yes.

7 MR. MAYFIELD: There's also past practice  
8 which says that a credible accident is any one whose  
9 likelihood of occurrence is one in a million per  
10 reactor year or greater, which is also not consistent  
11 with current staff practice. So there's lots of  
12 practice out there that has to be considered.

13 DOCTOR SPEIS: The other approach is the  
14 one that Len discussed. A variation of it could be to  
15 leave the numbers in the rule, whatever numbers we  
16 decide, the boundaries as well as the population  
17 density, but, based on scientific and engineering  
18 analysis, we'll call them some type of a maximum and  
19 say that anyone who meets those numbers they don't  
20 have to do anything. But there will be options for  
21 others to come forward with more detailed  
22 justifications and come up with lower EABs or lower  
23 population densities.

24 So these are some of the things we're  
25 talking about. There could be others as we proceed to

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1 suffer with this issue and we will be discussing the  
2 pros and cons and when we come to you in the near  
3 future we'll probably a number of options with our  
4 recommendations at that time.

5 Yes?

6 COMMISSIONER REMICK: You mentioned  
7 updating several reg guides, but not 4.7, and I think  
8 ACRS has suggested that parts of 4.7 should be updated  
9 also.

10 DOCTOR SPEIS: I meant to include that  
11 too.

12 COMMISSIONER REMICK: Okay.

13 DOCTOR SPEIS: I'm sorry. I wasn't all  
14 inclusive.

15 Yes?

16 CHAIRMAN SELIN: Doctor Speis or Mr.  
17 Sniezek or anybody who cares to answer, how much is  
18 your timing driven by the apparent need to have a rule  
19 in place to handle an advanced -- an early site  
20 application?

21 DOCTOR SPEIS: Well, the reason that we've  
22 put a valiant effort to get to the siting was because  
23 of the DOE's proposal at that time, but I guess right  
24 now --

25 MR. MIRAGLIA: At that time, at the early

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1 consideration, we were ahead of the decision and  
2 because of the delays we still remain ahead of the  
3 decision. I don't know if we have a date. There is  
4 still an ongoing activity. There is an activity under  
5 the Advanced Reactor Corporation where we're dealing  
6 with issues, but I don't believe we'll see a site  
7 application for a few years.

8 CHAIRMAN SELIN: Right. I wouldn't rule  
9 that out, but there are so many other considerations  
10 I would suggest it not take pride of place in your  
11 time and considerations.

12 I'd like to repeat a couple of principles  
13 or a few principles that the Commission has espoused  
14 at one time or another and then maybe explore how they  
15 apply here.

16 First of all, I think, quite frankly,  
17 you've done a lot better work than has come out in the  
18 discussion. You've done a lot more thinking about  
19 alternatives and approaches and I want to make sure  
20 that those get on the table today.

21 There's the question of timing, which I  
22 think is less pressing than perhaps has been  
23 considered.

24 There's what I'll call the bundesbank  
25 mentality that, you know, the job is not just to

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1 control, set some siting that American vendors can  
2 live with. We have to take into account that the  
3 whole world watches what we do. We still have to do  
4 things that are safe in the United States, but how we  
5 state these has an enormous impact overseas. So we  
6 can't just sort of ignore them and go ahead in our  
7 pieces.

8 The third, as Commissioner Remick has said  
9 a couple of times, is the concept of risk. And that's  
10 tied into performance versus prescription. For a  
11 comment rule, it's surprisingly prescriptive given the  
12 guidance that the Commission has said, to take risk  
13 into account, take performance into account.

14 And in fact, if I remember the April  
15 briefing -- this is a little bit over-simplified, but  
16 I think it's basically right -- when I asked why .4  
17 miles, the answer was "there are lots of sites in the  
18 United States that meet .4 miles, so why not?" which  
19 is not exactly a basis for a minimum acceptable piece.  
20 It would be much better, I think, to say what we mean  
21 and then let them be applied in different countries.

22 The fifth thing is the idea of a  
23 consistent and predictable practice. We've said over  
24 and over again that if a new generation of reactors is  
25 to be launched, people have to know what they're going

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1 to rely on. On the one hand, you don't want to put  
2 into concrete forever some kind of novel technology.  
3 But on the other hand, there's a lot to be said for  
4 putting things into a rule that can be changed, but  
5 it's hard to change them and that would be what you  
6 believe is really called for for the kind of  
7 technology that's available, both the evolutionary and  
8 the passive reactors.

9 But if we ever got a liquid metal or a  
10 high temperature gas, you would have to reexamine  
11 those. So I'm not saying it should be in a rule or a  
12 reg guide, but I think the concept that's important is  
13 before people make major financial or technical  
14 decisions what kind of assurance versus what kind of  
15 flexibility should they be given.

16 The last one is to sort of compare this  
17 with edge cases. Now, I have to tell you, personally  
18 I find nothing inconsistent with saying that a current  
19 site could be in an exclusionary area of, say, a  
20 quarter of a mile and be willing to let that go for  
21 another ten years, but at the same time saying we  
22 would not allow a new reactor to be built at that  
23 site. That does not bother me per se. But then when  
24 you take the next step, no new reactors for 40 or 60  
25 years, you take the next step and say, "We're allowing

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1 a current reactor with this older technology to stay  
2 in a site. We're designing newer, safer reactors but  
3 they have to have a larger exclusionary area." That's  
4 the part that's inconsistent. You're trading off a  
5 difference in time periods versus a difference in  
6 technology. All these lead to basically not being  
7 overly prescriptive in the rules.

8 So, it seems to me that we really have two  
9 approaches and there's a lot of argument both ways.  
10 One is to say, we'll set some very tough standards,  
11 but we'll call these surrogates, the 50 pound foot  
12 Charpy rule or the -- you know, as long as you meet  
13 this standard, you're home free. If not, come in and  
14 analyze them. The other approach says, we'll set a  
15 minimum standard that says under no conditions  
16 whatsoever will we consider something that doesn't  
17 meet these standards. But then you're talking about  
18 a much tighter zone. Maybe you don't even have  
19 population density. It just says that we look at a  
20 range, but these are the end points.

21 We've followed both of these at different  
22 points. Then you have a statement of consideration --  
23 not a statement of consideration, but a set of other  
24 principles that say, we won't absolutely say that  
25 that's all -- that you can't ever build a reactor with

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1 less than, say, a quarter of a mile, but generally  
2 we'd like to see a larger exclusionary area unless  
3 there's some good reason and you have to convince us  
4 why.

5 Now, I can see pros and cons in the two  
6 approaches. I'm not prescribing them. But I can't  
7 see any benefit to a prescriptive and overly  
8 conservative approach. I think that's the worst of  
9 all worlds.

10 Now, if you put a heavy weight on the  
11 international flavor, you would tend to put the  
12 minimal stuff into concrete and then say, this is the  
13 limit, you can't exceed these, but generally we'd like  
14 you to do better than that without necessarily laying  
15 out exactly how much better. The problem with the  
16 surrogate is that when it's translated into Japanese  
17 or French it comes out as a large limit that they  
18 can't meet.

19 But I think you've done a lot of thinking  
20 on these points and that your approach is a lot more  
21 sophisticated than it was when the draft went out, and  
22 without saying how it comes out. Those are the kind  
23 of considerations.

24 At different points the Commission has  
25 said these are important in our regulation and

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1 certainly when you're trying to redo a regulation  
2 based on a rather vague future requirement and trying  
3 to get it really right rather than make a short-term--  
4 you know, it's not like plant life extension where we  
5 have a problem today and we wish we had done something  
6 a little differently two years ago, but we're just  
7 trying to fix it. Here you really are going back more  
8 or less to ground zero. Well, that's not a good  
9 phrase.

10 So, let's look at these principles and  
11 take your time and get them right.

12 Commissioner Rogers?

13 COMMISSIONER ROGERS: Are we finished?

14 CHAIRMAN SELIN: No. We're finished with  
15 this point.

16 DOCTOR SPEIS: We still have the seismic  
17 aspect, but maybe let's finish this.

18 COMMISSIONER REMICK: I would just add one  
19 thing. Is there anything we can glean from other  
20 international practice in the siting area that would  
21 be applicable or helpful to us? You don't have to  
22 answer that now, but I don't know exactly how siting  
23 is determined in other countries of interest.

24 DOCTOR SPEIS: Well, as you know, the  
25 Europeans have a very tight coupling between the

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1 source term and severe accident considerations. So,  
2 their approach is a very simple one where they say to  
3 themselves, I want to have a realistic source term and  
4 the containment, and considering the most probable  
5 challenges to the containment, what can I do to  
6 prevent them or reduce the consequences? That led  
7 them to the filters, as you know.

8 COMMISSIONER REMICK: Do they have a  
9 minimum?

10 DOCTOR SPEIS: No, they don't have a  
11 minimum.

12 COMMISSIONER REMICK: But they probably  
13 have a practical one for security or something else,  
14 yes.

15 DOCTOR SPEIS: It varies, depending on the  
16 specific site.

17 May we continue? Oh, I'm sorry.

18 CHAIRMAN SELIN: Did you have something  
19 you wanted to say?

20 COMMISSIONER de PLANQUE: No. No.

21 CHAIRMAN SELIN: Please continue.

22 DOCTOR SPEIS: Doctor Murphy will now go  
23 to the seismic parts, which also have generated some  
24 controversy.

25 DOCTOR MURPHY: (Slide) If we'll go to

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1 slide 17, which is simply an outline of the four items  
2 that I'm going to touch on, the important point to  
3 make again is the one that's been discussed several  
4 times here, is that this is staff with a small S  
5 decisions and thoughts of the process. We have not  
6 sought or gotten a management concurrence on the  
7 proposed hybrid that we are going to be talking about  
8 later in this presentation. So, what we're looking at  
9 is fairly preliminary thoughts on the process.

10 (Slide) Viewgraph 18 again touches simply  
11 upon the reasons why the staff has gotten involved in  
12 a revision to Appendix A, that the regulation has been  
13 on the books for approximately 20 years now and that  
14 there have been considerable discussion about revising  
15 this document. Within the area of seismology, what  
16 we're concerned about at this stage is the use of  
17 probabilistic techniques. That is the principle thing  
18 that the current regulation doesn't reflect as far as  
19 the geosciences are concerned.

20 The current regulation, is this thing  
21 prescriptive and it's very prescriptive in what it  
22 tells the applicant to do by way of his geoscience  
23 investigations. What we would like to do is take  
24 those prescriptive materials and remove them from the  
25 regulation itself.

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1           There has been considerable difficulty  
2 over the years with the application of this regulation  
3 because of conflicting interpretations of what it is  
4 actually saying. A classical example here would be  
5 the Indian Point hearings over what a capable fault  
6 was. That dragged on for considerable time and  
7 required considerable resources both on the state, the  
8 applicant and the intervenor before that item was  
9 resolved and the plant was licensed.

10           The regulation also contains conflicting  
11 definitions within itself of the operating basis  
12 earthquake, has three definitions of descriptions  
13 within the regulation. Again, this has led to  
14 conflicting emphasis as the plants have been licensed.

15           (Slide) If we'll flip to viewgraph 19 and  
16 take a look at the objectives of the current revision.

17           Again, we start off by talking about the  
18 decoupling of the siting requirements from the design  
19 or engineering requirements. In this case what we are  
20 talking about is, in effect, separating the geoscience  
21 investigations from the engineering or design  
22 requirements. Here what we're principally talking  
23 about is moving the definition of the operating basis  
24 earthquake in its uses from the Part 100 site where it  
25 is now to Part 50 which just simply goes along with

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1 good regulation. The Part 100 is descriptive material  
2 on siting and our Part 50 basically is an engineering  
3 requirement. So, it is appropriate to take and move  
4 those pieces out of there.

5 Again, we're interested in taking the  
6 guidance out of the document, out of the materials  
7 that we're interested in being able to change readily  
8 and keeping the basic requirements within the  
9 regulation itself so that the regulation as proposed  
10 would be a fairly simple document with the guidance  
11 elsewhere. We're interested, obviously, in updating  
12 the technical requirements and at this stage for the  
13 siting part. That principally means making use of  
14 probabilistic techniques.

15 For engineering, we're very much concerned  
16 with redefining the operating basis earthquake. What  
17 we have proposed at this time is that for applicants  
18 that select an OBE less than or equal to one-third of  
19 the SSC, that basically no additional analysis  
20 required and the OBE functions principally as an  
21 inspection level earthquake.

22 In that vein, what we're interested --

23 COMMISSIONER REMICK: That is consistent,  
24 I assume, with what the Commission has approved in 93-  
25 087, right? What you're proposing here is consistent

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1 with what the staff recommended there?

2 DOCTOR MURPHY: Yes, that's correct. The  
3 other thing that is happening in association with this  
4 redefinition of the operating basis earthquake is the  
5 preparation of several reg guides, one of which  
6 contains criteria on OBE shutdown and the other is  
7 guidance on what must occur or what should occur  
8 before an OBE -- a plant that has been shut down for  
9 an OBE is restarted.

10 (Slide) We flip to viewgraph 20 and we  
11 look at the public comment analysis. Here we'll first  
12 look at the comments that we've gotten from United  
13 States commenters. Again here is the number, simply  
14 numbers, that are approximately 46 out of the 80 or so  
15 commenters specifically commented on the seismic  
16 criteria.

17 I will note that it's my recollection that  
18 none of them specifically commented on the decoupling  
19 or the separation of the siting from design.

20 Basically it has been very much of a mixed  
21 bag. It runs from folks that are very much in favor  
22 of the deterministic approach as in the current  
23 regulation to those that are very strongly in favor of  
24 an entirely probabilistic approach.

25 I've noted that seven of the state

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1 geological surveys actually provided comment. Again,  
2 they were principally supportive of a deterministic  
3 approach. I will note for the flip side of that the  
4 Association of State Geologists has a committee on  
5 geological hazards. That committee and its chairman  
6 wrote to us basically supporting the idea of some sort  
7 of a combined approach or a hybrid approach, making  
8 use of probabilistic analysis and deterministic  
9 analysis. So, even within that small community  
10 there's divergence of opinion.

11 We have interacted considerably with the  
12 folks from the U.S. Geological Survey. In a comment  
13 letter to us they have recommended the use of  
14 probabilistic analysis with a simplified deterministic  
15 check on that probabilistic analysis.

16 COMMISSIONER REMICK: Which would they  
17 indicate is the deterministic one? Did they indicate?  
18 As I read your words here, but I don't know if it's  
19 what they said, it seems to me that the deterministic  
20 would still be used, but you'd use probabilistic as  
21 some independent insight. But I might be wrong. I'm  
22 not sure.

23 DOCTOR MURPHY: I'll say it's the other  
24 way around and I'll touch on that one in my last  
25 viewgraph when we look at the key elements of the

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1        hybrid approach.

2                    We've gotten an extensive comment letter  
3        from NUMARC with support in preparation by EPRI and  
4        basically what they have proposed is what they've  
5        called an integrated probabilistic deterministic  
6        approach. It has many of the features that we are  
7        proposing or thinking about in our hybrid approach.

8                    The folks at the Nuclear Safety Research  
9        Review Committee have also provided comments. There  
10       they felt, taking another view, that the probabilistic  
11       analysis and evaluation was definitely a step forward,  
12       but continued use of the traditional deterministic  
13       evaluation is basically going backwards again.

14                   We had a very strong letter from the  
15       Association of Engineering Geologists in which they  
16       questioned the maturity of the probabilistic analysis.  
17       They did not think it was ready to be used in a  
18       regulation yet.

19                   COMMISSIONER REMICK: How about the seven  
20       state geologic surveys? Was that their reason also or  
21       did they have other reasons?

22                   DOCTOR MURPHY: They were not as clear in  
23       their approach to it. One would read between the  
24       lines that their questions again would be running to  
25       the maturity of the process and its practice in the

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1 past.

2 (Slide) Again if we flip to 21 we touch  
3 upon the comments that we have received  
4 internationally. There was a group of approximately  
5 ten utilities that wrote in as a group. Again they  
6 questioned the required use of the probabilistic  
7 analysis and the difficulties that it might cause them  
8 at home.

9 There was another group of I'll say  
10 independent comments from Canada, Scotland, Israel,  
11 Italy, Korea where they had individual comments about  
12 the use of the probabilistic and deterministic. Here  
13 their concerns were more with the deterministic  
14 definitions that were in our rule as published for  
15 public comment.

16 It was a bit of a mixed bag in here in  
17 that some of them thought some of the ideas were  
18 reasonable and a good step forward, but suggested  
19 basically we rethink some of this material.

20 COMMISSIONER REMICK: One of the questions  
21 I have and I guess my just intuitive leaning would be  
22 toward the probabilistic approach because it sounds  
23 like it's more modernistic than deterministic. But  
24 you seem to emphasize that there's been a lot of  
25 litigation in the past in a deterministic approach and

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1 that's certainly true. But I see by adding another  
2 technique and not defining which one is overriding and  
3 knowing that the probabilistic approach has a lot of  
4 uncertainty, tremendous amount of uncertainty, and  
5 aren't we just adding to uncertainty and potential for  
6 litigating not only things like capable fault but now  
7 uncertainties and probabilities, all those type of  
8 things? It seems like we aren't in any way reducing  
9 the potential for discussion and litigation on complex  
10 matters, that we actually would be increasing the  
11 number possibly.

12 DOCTOR MURPHY: Obviously our intent is  
13 not to go that way. The intent with the probabilistic  
14 analysis is to capture the uncertainty and the  
15 diversity of opinion that has been expressed about the  
16 seismic hazard so that in looking at the probabilistic  
17 analysis that have been carried out we can  
18 legitimately say that the concerns and issues raised  
19 by particular individuals at a particular hearing have  
20 been addressed and have been put into some sort of a  
21 proper perspective so that while they're not set aside  
22 and neglected we can say that we have looked at these  
23 and we've looked at the consequences of these proposed  
24 models and this is the way they turn out.

25 COMMISSIONER REMICK: Yes. But isn't just

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1 a question of whether you've looked at it. People  
2 question whether you've come to the right conclusion  
3 after looking at it. When you get into the  
4 probabilistic area, you really are opening up a lot of  
5 doors, it seems to me. Believe me, I'm not against  
6 the probabilistic approach.

7 Another thing that has concerned me as  
8 much as 93-087, the staff is recommending that we go  
9 away from seismic PRAs and go to seismic shutdown  
10 margin. I assume the reason for that is because of  
11 the uncertainties and so forth.

12 DOCTOR MURPHY: Part of the process that  
13 we are going through, although we have not gone to  
14 these particular committees for comment specifically  
15 on our regulation, is to have the products that we're  
16 using to carry out this probabilistic analysis looked  
17 at by prestigious peer groups. We have gone and will  
18 continue to go to the National Academy of Science and  
19 National Academy of Engineering for comment and  
20 thought on not the regulation itself so much as the  
21 procedures and so forth that we are using, the  
22 technical advice.

23 COMMISSIONER REMICK: That's good, because  
24 later I was going to point out it seems like this is  
25 ripe for some kind of an international peer workshop

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1 or something to discuss these various problems before  
2 we jump one way or another. I'm glad to hear that.

3 DOCTOR MURPHY: (Slide) On viewgraph 22  
4 we take a look at what the staff's thoughts have been  
5 since the regulation was published, since we have  
6 interacted and received the public comments. Very  
7 simply what we have is a process where we would be  
8 conducting or have the applicant conduct a  
9 probabilistic seismic hazard analysis as described in  
10 the current package. They would also be required to  
11 go ahead with site-specific and region-specific  
12 geoscience investigations. This would include  
13 everything from on-site borings to examination of the  
14 seismic history in the area, particularly looking at  
15 material that may have become available since the  
16 probabilistic seismic databases were collected.

17 Very specifically the geoscience  
18 investigations would be used to look at the  
19 probabilistic results to see if there is new  
20 information that should be taken into consideration.

21 At that stage we would go ahead and make  
22 the specific calculations. This would be the  
23 acceleration, the SSC ground motion for the plant  
24 itself. The following item is the one that has been  
25 suggested by the USGS comments, which I think the

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1 staff that has been involved agree wholeheartedly  
2 with, and that is for some sort of a simplified  
3 deterministic check of a probabilistic analysis. Here  
4 the point would be that the probabilistic analysis  
5 would be acceptable and would be used as a basis for  
6 licensing if it passed a particular check. Some of  
7 the thoughts that the staff has on it at this stage is  
8 that that would be a particular difference between the  
9 deterministic and the probabilistic check. If that  
10 difference was less than a specific value, the  
11 probabilistic analysis would be accepted in use and,  
12 as I said, used for the licensing basis.

13 The staff has been looking at this and  
14 taking into considerations the margins that may be  
15 associated with the design codes. Also, the  
16 considerations of the ground motion and the  
17 meaningfulness of the changes in various levels.

18 In a previous Commission briefing we  
19 talked about this and I'd say at this stage those are  
20 very simple ideas. The staff has not fully gelled on  
21 a full blown justification for description or  
22 explanation of how we would carry these out. It's  
23 still early in our process.

24 COMMISSIONER REMICK: Would this be our  
25 first use of a probabilistic analysis in licensing and

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1 making the decision?

2 DOCTOR MURPHY: To the best of my  
3 knowledge. Certainly in this area.

4 COMMISSIONER REMICK: I'm thinking in  
5 general. Do we have any --

6 MR. BAGCHI: My name is Goutam Bagchi.  
7 I'm Chief of Civil Engineering and Geosciences Branch  
8 and I wanted to mention that for identifying plants  
9 into different groups we did use probabilistic  
10 results.

11 MR. MIRAGLIA: But that was for  
12 reevaluation, I think.

13 MR. BAGCHI: For reevaluation.

14 MR. MIRAGLIA: The Commissioner's question  
15 was if we used this approach to determining the design  
16 basis earthquake for initial licensing and I believe  
17 the answer to that question is no.

18 COMMISSIONER REMICK: Yes. It was  
19 actually broader than that. It was the uses of  
20 probabilistic analysis in the actual decision of a  
21 licensing matter versus insight.

22 MR. MALSCH: Just to add, we've used that  
23 in the past, not only in getting involved in hearings  
24 and defining credible and applying Part 100, but also  
25 have used it for off-site hazards, explosions, natural

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1 gas tankers and things of that sort. So, it's not --

2 COMMISSIONER REMICK: You're right.  
3 You're right.

4 MR. MALSCH: -- absolutely unique.

5 COMMISSIONER REMICK: Yes. Okay. Now I  
6 understand.

7 DOCTOR SPEIS: Okay.

8 COMMISSIONER de PLANQUE: Do I understand  
9 from your last remark that you haven't looked any  
10 further into the problems and the uncertainty on the  
11 probabilistic number when comparing that to the  
12 deterministic number?

13 DOCTOR MURPHY: We have looked at them  
14 further, but are just not prepared to discuss them at  
15 this time.

16 COMMISSIONER de PLANQUE: Fine.

17 COMMISSIONER REMICK: Before we leave  
18 that, your first bullet in that last slide, slide  
19 number 22, conduct probabilistic seismic hazard  
20 analysis, I assume we could still require them to be  
21 using the EPRI method and the LANO method, even though  
22 those are apparently closer together now?

23 DOCTOR MURPHY: It's guidance. We're not  
24 requiring them to use EPRI. And it's Livermore, not  
25 LANO, and we are examining the differences, yes, and

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1 we are aware that there are other potential contenders  
2 out there that are being proposed or worked on by  
3 individual consulting firms, but the bottom line is  
4 we're not requiring those to simply have the -- in the  
5 guidance suggested their use and examined their use  
6 for that guidance.

7 COMMISSIONER REMICK: Both or one or the  
8 other?

9 DOCTOR MURPHY: At this stage, we're  
10 saying that they may use either one.

11 COMMISSIONER REMICK: Either one.

12 In the document, and I guess it has to do  
13 with the calculated site-specific ground motion for  
14 the plant, you have wording something like they would  
15 have to demonstrate that the probability of exceeding  
16 the safe shutdown earthquake ground motion -- and I  
17 assume that's the acceleration of the ground motion--  
18 at the site should be lower than the median  
19 probability of exceeding for the current population of  
20 plants.

21 If one did that, what would be the median  
22 probability of ground motion acceleration for the  
23 existing plants?

24 DOCTOR MURPHY: If we're talking the  
25 calculations that were carried out using the Livermore

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1 process, it would be  $1 \times 10^{-4}$ . If we're talking about  
2 the calculations for EPRI, I believe it's  $3 \times 10^{-5}$ , so  
3 that there is a difference.

4 COMMISSIONER REMICK: But what would be  
5 the median probability? Maybe you've answered that  
6 and I didn't understand.

7 DOCTOR MURPHY: The median probability, if  
8 the applicant chose to use the Livermore process, the  
9 Livermore probabilistic analysis, would be  $1 \times 10^{-4}$ .

10 COMMISSIONER REMICK:  $1 \times 10^{-4}$ .

11 DOCTOR MURPHY: If the applicant selected  
12 the EPRI codes, databases, the median would be  $3 \times 10^{-5}$ .  
13 So within the guidance, there are specifically two  
14 different medians, two different median target levels.

15 COMMISSIONER REMICK: Okay. Now if they  
16 always had to demonstrate that they were below the  
17 median, over a period of time the median would  
18 presumably continue downwards, if everybody had to be  
19 low. Is that correct?

20 DOCTOR MURPHY: If we went in and we  
21 changed those numbers. As it's written right now,  
22 we're going with the medians as fixed and associated  
23 with the current population.

24 COMMISSIONER REMICK: I see. So it  
25 wouldn't change if additional sites were added?

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1 DOCTOR MURPHY: No. We would have to go  
2 back into the guidance -- I forget whether it's in  
3 the guidance or the regulation, I believe in the  
4 guidance -- and have to change those guidance numbers  
5 to account for that change which would change with  
6 time.

7 COMMISSIONER REMICK: I interpreted  
8 "current" to mean whatever time one looked at it would  
9 be the current plants at that time, therefore I saw  
10 that if you kept adding things that were below the  
11 median the median would be shifting downwards over  
12 time. But that's not the intent?

13 DOCTOR MURPHY: The intent is to draw a  
14 line in time and say "current meant before this date."

15 COMMISSIONER REMICK: I see. Okay. All  
16 right. That's all. Thanks.

17 DOCTOR SPEIS: We have one more viewgraph  
18 to go, one more subject.

19 (Slide) Viewgraph number 24, please.

20 This shows the status of the advanced  
21 notice of proposed rulemaking on severe accident,  
22 which is, as I said earlier, the initiation of the  
23 Part 50 revision to address the complete severe  
24 accident issue.

25 We issued the ANPR for comment on

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1 September 28th and the objective was to get comments  
2 on the potential value and also the best means of  
3 implementing generic rules, because there are a  
4 variety of ideas. For example, the ACRS has proposed  
5 that we revise the general design criteria to  
6 incorporate the effect of severe accidents.

7 There are other ideas like to use a  
8 phenomenon-oriented rule, you know, just to identify  
9 the phenomenon and let the licensees use their  
10 ingenuity to handle them.

11 There are other ideas like a hardware-  
12 oriented rule where you prescribe things that have to  
13 be there to take care of some of the challenges to  
14 containment.

15 We got a number of comments. We have  
16 briefed the ACRS. For example, we got three  
17 commenters who were in favor of a generic rulemaking.  
18 Seven of them were opposed.

19 We don't think that, from the comments, we  
20 got any consensus on the need or value of a generic  
21 rulemaking, however we feel that the individual  
22 comments when taken together provide some additional  
23 insights.

24 Our objective is to keep working with the  
25 ACRS. The ACRS did send a letter recently saying that

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1 we should pursue this and we told the ACRS that we  
2 don't plan to issue any rules until the SERs dealing  
3 with severe accidents for the advanced LWRs are  
4 completed so we're not going to get in the way of the  
5 process.

6 The basic objective here is really to  
7 codify Commission guidance dealing with severe  
8 accidents which you people have provided for the  
9 advanced light water reactors and, as I said earlier,  
10 to complete this whole severe accident --

11 CHAIRMAN SELIN: What argument could one  
12 make against having a generic rule in this area?

13 DOCTOR SPEIS: Well, right now they say  
14 that it will interfere with the certification process,  
15 you know, the rulemaking, the generic rulemaking will  
16 kind of distract us from pursuing the plant-specific  
17 certification.

18 Others say there is no need, the guidance  
19 already in part 52 is okay, is enough, or the guidance  
20 that will be codified in the individual certifications  
21 is enough.

22 So these are the type of comments we got  
23 and we are sending you a Commission paper, because you  
24 have asked for it, going into great detail with  
25 identifying the comments and the different views and

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1 our recommendations at this time.

2 COMMISSIONER REMICK: In the advanced  
3 notice of proposed rulemaking you had three  
4 alternatives. Am I correct that what we're following  
5 in the evolutionary and passive reviews is your  
6 alternative to --

7 DOCTOR SPEIS: I think it's a mixture of  
8 hardware and phenomena, basically.

9 COMMISSIONER REMICK: So it's a mixture of  
10 1 and 2?

11 DOCTOR SPEIS: Yes. For example, to deal  
12 with the issue of hydrogen we specify the amount of  
13 hydrogen to be considered, but we say you can use a  
14 strong containment. You can use igniters. You can  
15 use anything that you can --

16 COMMISSIONER REMICK: But I thought that  
17 was closer to alternative 2.

18 DOCTOR SPEIS: Well, as I say, it's a  
19 combination.

20 COMMISSIONER REMICK: Okay. Because,  
21 alternative 1 was equipment, if I recall, specifying  
22 some --

23 DOCTOR SPEIS: Yes, yes. Alternative 1 is  
24 hardware, 2 is phenomena, 3 is the GDC, revising the  
25 GDC.

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1 COMMISSIONER REMICK: Okay. So we in a  
2 way are setting a precedent, at least for those  
3 plants.

4 MR. MIRAGLIA: Certainly, as Doctor Speis  
5 has indicated, in the design certification rules that  
6 processes that are ongoing where we've come with  
7 policy decisions we have made decisions in those areas  
8 and, as Themis points out, some of them are  
9 phenomenological, some of them go towards hardware,  
10 and it's kind of --

11 DOCTOR SPEIS: In some cases where there  
12 is good consensus on the phenomena and there are some  
13 good ideas how to handle them, then we are more  
14 specific and that way avoid litigation.

15 In some other areas where there is still  
16 a variety of views and there is a kind of semi-  
17 consensus that some of these phenomena have low  
18 probability, then we say "take another look at this to  
19 make sure, for example, whether hydrogen accumulates  
20 in some part of the containment. Let's take a good  
21 look at it to make sure that you don't have local  
22 detonations or something like that."

23 COMMISSIONER REMICK: But those are  
24 basically the alternatives --

25 DOCTOR SPEIS: Yes.

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1 COMMISSIONER REMICK: -- and you're still  
2 considering variations?

3 DOCTOR SPEIS: Yes, sir. We have asked  
4 for additional views on other ways, but we haven't  
5 gotten any additional ideas. Basically, those are the  
6 three approaches.

7 With that, Mr. Chairman, Commissioners,  
8 our presentation has come to an end.

9 CHAIRMAN SELIN: I'd like to go back to  
10 the basic question of the -- particularly Part 100.  
11 It seems to me, and I wonder if you're prepared to  
12 discuss this a little bit, that we're talking about an  
13 eventual Part 100 that will look very different from  
14 the rule that was put out for comment. It's not just  
15 a question of what the numbers are. We have real  
16 questions about the form and the content as well as  
17 the numbers.

18 I made a little list of things that,  
19 whatever you come up with, I would like to see you  
20 evaluate how you took each of these into account.

21 One is risk and safety goals.

22 The second is degree of performance versus  
23 prescription.

24 The third is, would this support the  
25 concept of consistent and predictable practice?

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1           The fourth is the international  
2 considerations. I mean, without saying how much  
3 weight should go into certainly any recommendation, we  
4 will want to look and see what the impact would be  
5 overseas.

6           The fifth is, how does this deal with our  
7 traditional approach to defense in depth?

8           The sixth is, how do you come down on how  
9 to reconcile deterministic and probabilistic  
10 approaches?

11           There might be a couple of other points.

12           The question I have is not at all clear in  
13 my mind, let alone in the Commission's. Are you  
14 better off at this point trying to come up with a  
15 whole draft rule which would look quite different in  
16 form and content and substance and have different  
17 numbers in it, something the Commission could respond  
18 to quite explicitly, but if you got off on the wrong  
19 tack, you know, you'd have to redo everything?

20           Or, are you better off trying to take what  
21 you discussed today, different ways of solving the  
22 point with some samples of what the numbers might look  
23 like but without actually trying to do all the work,  
24 and come back to the Commission for intermediate  
25 guidance?

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1                   On the one hand you don't want the  
2 Commission making decisions on superficial analysis.  
3 On the other hand you don't want to spend a huge  
4 amount of time and then come up with something where  
5 we say, not only do we not agree with your number, but  
6 we want you to do a different outline.

7                   MR. SNIEZEK: I think the Commission has  
8 provided us quite a bit of guidance today in the  
9 discussions and I think --

10                  CHAIRMAN SELIN: No, no, no. We don't  
11 provide guidance, we provide insight.

12                  MR. SNIEZEK: Insights in the discussion  
13 and I think that it would be appropriate for the staff  
14 as we come back to the Commission with options, taking  
15 into account the whole range of discussion that took  
16 place today. We wouldn't necessarily have to come  
17 with a specific recommendation at that time and look  
18 for further guidance at that time from the Commission.

19                  CHAIRMAN SELIN: Commissioner Rogers?

20                  COMMISSIONER ROGERS: No, I think I've  
21 heard a very excellent presentation.

22                  COMMISSIONER REMICK: Nothing further,  
23 thank you.

24                  CHAIRMAN SELIN: Commissioner?

25                  COMMISSIONER de PLANQUE: Nothing further.

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1 Thank you.

2 CHAIRMAN SELIN: Okay. And just the last  
3 thing. I don't know if it's a good idea or not  
4 because you have already put out a draft on this  
5 appendix, but the idea of some kind of an  
6 international workshop where you really have got  
7 experts together. Of course it would be an open  
8 workshop is certainly consistent with the practice  
9 we've been following for the last few years. If that  
10 turns out to be a good idea, it certainly has some  
11 superficial attraction.

12 It's consistent with the concept that  
13 whether we like it or not we really are writing  
14 international regulations in this area and we have to  
15 control American safety, but we should be sensitive to  
16 the impacts overseas and also learn from what other  
17 people have done in similar areas.

18 Thank you.

19 COMMISSIONER ROGERS: Thank you very much.

20 (Whereupon, at 11:35 a.m., the above-  
21 entitled matter was concluded.)

22

23

24

25

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TITLE OF MEETING: BRIEFING ON STATUS OF PART 100 RULE CHANGE AND  
PROPOSED UPDATE ON SOURCE TERM AND RELATED ISSUES  
PLACE OF MEETING: ROCKVILLE, MARYLAND

DATE OF MEETING: AUGUST 3, 1993

were transcribed by me. I further certify that said transcription  
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**COMMISSION BRIEFING**  
**ON**  
**STATUS OF PROPOSED SOURCE TERM UPDATE**  
**STATUS OF PART 100 RULE CHANGE**  
**AND**  
**RELATED ISSUES**

**THEMIS P. SPEIS**  
**LEONARD SOFFER**  
**ANDREW J. MURPHY**  
**OFFICE OF NUCLEAR REGULATORY RESEARCH**  
**U.S. NUCLEAR REGULATORY COMMISSION**

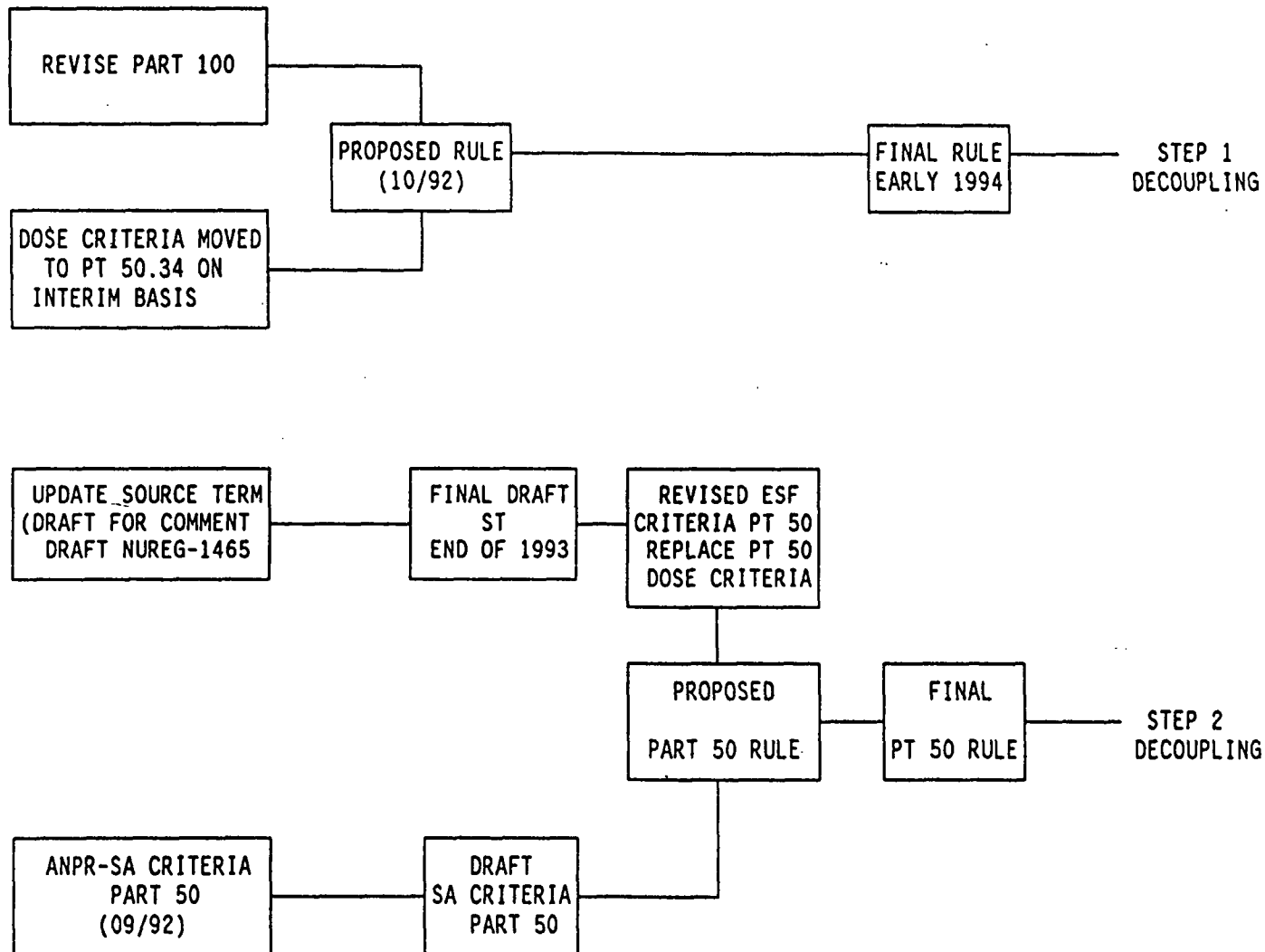
**AUGUST 3, 1993**



## **OUTLINE OF PRESENTATION**

- o BACKGROUND**
- o SOURCE TERM UPDATE STATUS**
  - ISSUANCE OF DRAFT NUREG-1465**
  - MAJOR COMMENTS**
  - PROPOSED REVISION**
  - SCHEDULE**
- o PART 100 RULE CHANGE STATUS**
  - PROPOSED RULE**
  - COMMENTS RECEIVED**
  - PROPOSED DIRECTION**
  - SCHEDULE**
- o ANPR ON SEVERE ACCIDENTS**

## BACKGROUND



## **SOURCE TERM UPDATE**

## SOURCE TERM UPDATE

- o DRAFT NUREG-1465 ISSUED FOR COMMENT JULY 1992
- o COMMENTS SOLICITED FROM INTERNATIONALLY RECOGNIZED EXPERTS AS WELL AS PUBLIC. 20 COMMENTS RECEIVED FROM UTILITIES, INDIVIDUALS, INTERNATIONAL AND NATIONALLY RECOGNIZED RESEARCHERS.
- o BASED UPON RANGE OF SEVERE ACCIDENT SEQUENCES STUDIED IN NUREG-1150.
- o INTENDED TO REPRESENT GENERALIZED PROGRESSION OF A SEVERE ACCIDENT, INCLUDING PRESSURE VESSEL FAILURE. NOT INTENDED TO REPRESENT ANY SINGLE SEQUENCE.
- o PURPOSE IS TO PROVIDE A MORE REALISTIC REPRESENTATION OF A SEVERE ACCIDENT FOR DESIGN OF PLANT MITIGATION SYSTEMS.
- o RELEASE FRACTIONS BASED UPON MEAN ESTIMATES FROM NUREG-1150.
- o REVISED IODINE CHEMICAL FORM

## **MAJOR COMMENTS**

- o COMMENTS LARGELY FAVORABLE. REVISED SOURCE TERM INCORPORATES SEVERE ACCIDENT INSIGHTS AND REPRESENTS MAJOR ADVANCE OVER TID-14844. MAJOR COMMENTS INCLUDE:**

- EARLY IN-VESSEL RELEASES ARE TOO LOW WHILE EX-VESSEL RELEASES ARE TOO HIGH.**
- RELEASES FOR LOW VOLATILE NUCLIDES - BOTH IN-VESSEL AND EX-VESSEL - ARE TOO HIGH.**
- FRACTIONS FOR GAP RELEASE PHASE ARE TOO HIGH.**
- IODINE CHEMISTRY IS VERY COMPLEX - BE CAREFUL ABOUT SPECIFICATION OF IODINE CHEMICAL FORM.**
- DRY CAVITY RELEASES INAPPROPRIATE FOR ALWRS.**
- REMOVAL MECHANISMS NEED BETTER TREATMENT.**

**PWR RELEASES INTO CONTAINMENT\***  
**(DRAFT NUREG-1465)**

	<b>GAP RELEASE</b>	<b>EARLY IN- VESSEL</b>	<b>EX-VESSEL**</b>	<b>LATE IN- VESSEL</b>
<b>DURATION (HOURS)</b>	<b>0.5</b>	<b>1.3</b>	<b>2</b>	<b>10</b>
<b>NOBLE GASES</b>	<b>0.05</b>	<b>0.95</b>	<b>0</b>	<b>0</b>
<b>IODINE</b>	<b>0.05</b>	<b>0.35</b>	<b>0.29</b>	<b>0.07</b>
<b>CESIUM</b>	<b>0.05</b>	<b>0.25</b>	<b>0.39</b>	<b>0.03</b>
<b>TELLURIUM</b>	<b>0</b>	<b>0.15</b>	<b>0.29</b>	<b>0.025</b>
<b>STRONTIUM</b>	<b>0</b>	<b>0.03</b>	<b>0.12</b>	<b>0</b>
<b>BARIUM</b>	<b>0</b>	<b>0.04</b>	<b>0.10</b>	<b>0</b>
<b>RUTHENIUM</b>	<b>0</b>	<b>0.008</b>	<b>0.004</b>	<b>0</b>
<b>CERIUM</b>	<b>0</b>	<b>0.01</b>	<b>0.02</b>	<b>0</b>
<b>LANTHANUM</b>	<b>0</b>	<b>0.002</b>	<b>0.015</b>	<b>0</b>

**\* VALUES SHOWN ARE FRACTIONS OF CORE INVENTORY**

**\*\* VALUES SHOWN ARE FOR A DRY REACTOR CAVITY**

**PWR RELEASES INTO CONTAINMENT\***  
**(EPRI PASSIVE PLANT)**

	<b>GAP RELEASE</b>	<b>EARLY IN- VESSEL</b>	<b>EX-VESSEL</b>	<b>LATE IN- VESSEL</b>
<b>DURATION (HOURS)</b>		<b>4.</b>		<b>19</b>
<b>NOBLE GASES</b>	--	<b>0.80</b>	--	<b>0.20</b>
<b>IODINE</b>	--	<b>0.38</b>	--	<b>0.17</b>
<b>CESIUM</b>	--	<b>0.30</b>	--	<b>0.18</b>
<b>TELLURIUM</b>	--	<b>0.08</b>	--	<b>0.03</b>
<b>STRONTIUM</b>	--	<b>0.004</b>	--	--
<b>BARIUM</b>	--	<b>0.004</b>	--	--
<b>RUTHENIUM</b>	--	<b>0.004</b>	--	--
<b>CERIUM</b>	--	<b>0.00004</b>	--	--
<b>LANTHANUM</b>	--	<b>0.00004</b>	--	--

**\* VALUES SHOWN ARE FRACTIONS OF CORE INVENTORY**

## **FINALIZING NUREG-1465**

- o RESPONSES TO COMMENTS**
- o INCORPORATE INSIGHTS FROM REMOVAL MECHANISMS**
- o FINAL NUREG-1465 EXPECTED TO INCORPORATE COMMENTS DEALING WITH**
  - IN-VESSEL RELEASES FOR VOLATILE AND NON-VOLATILE NUCLIDES**
  - GAP RELEASE FRACTIONS**
  - EXPLICIT CONSIDERATION OF EX-VESSEL RELEASES.**
- o FINAL NUREG-1465 EXPECTED TO BE ISSUED END OF 1993.**



**REVISION OF PART 100**  
**(NON-SEISMIC ASPECTS)**

**REACTOR SITE CRITERIA (PART 100)**  
**(NON-SEISMIC)**

**PRESENT**

- o FISSION PRODUCT RELEASE (TID-14844) POSTULATED INTO CONTAINMENT. DOSES EVALUATED AT EXCLUSION AREA BOUNDARY AND LPZ OUTER RADIUS.
- o PART 100 IS VERY FLEXIBLE AND HAS NO NUMERIC CRITERIA FOR EAB AND LPZ SIZE.
- o REG. GUIDE 4.7 (1975) PROVIDES GUIDANCE ON POPULATION DENSITY WITHIN 30 MILES FROM THE REACTOR

**PROPOSED RULE**

- o SOURCE TERMS AND DOSE CRITERIA TO BE DELETED FOR SITE EVALUATION.
- o PROPOSED MINIMUM EXCLUSION AREA SIZE OF 0.4 MILES AND POPULATION DENSITY CRITERIA OF 500 PERSONS PER SQUARE MILE OUT TO 30 MILES.
- o PHYSICAL CHARACTERISTICS THAT COULD POSE SIGNIFICANT IMPEDIMENT TO DEVELOPMENT OF EMERGENCY PLANS TO BE IDENTIFIED.
- o EVALUATION OF MAN-RELATED HAZARDS REQUIRED.

## **STATUS OF PART 100 REVISION**

- o PROPOSED RULE ISSUED FOR COMMENT OCTOBER 20, 1992.**
- o COMMENTS SOLICITED FROM INTERNATIONAL COMMUNITY.**
- o COMMENT PERIOD (EXTENDED TWICE) EXPIRED JUNE 1, 1993.**
- o OVER 80 COMMENT LETTERS RECEIVED.**

## **PUBLIC COMMENTS**

### **I. INTERNATIONAL**

- o DON'T DECOUPLE SITING FROM DESIGN**
- o DON'T SPECIFY EXCLUSION AREA DISTANCES**
  - TOO RESTRICTIVE**
  - NO TECHNICAL BASIS**
- o DON'T PUT POPULATION DENSITY CRITERIA IN REGULATIONS**
  - TOO RESTRICTIVE**
  - KOREA, JAPAN AND TAIWAN "WOULD NOT BE ABLE TO COMPLY"**
- o REG. GUIDE 4.7 HAS WORKED AND CONTINUES TO WORK SUFFICIENTLY**
- o RULE WOULD HAVE "... A GREAT IMPACT ON OUR LOCAL [TAIWAN] NUCLEAR DEVELOPMENT YET HAVE NO SIGNIFICANT SAFETY ENHANCEMENT"**

## **II. DOMESTIC**

### **A. INDUSTRY**

- o DON'T CODIFY REG. GUIDE 4.7**
- o DON'T PUT NUMERICAL POPULATION DENSITY IN REGULATIONS - TOO RESTRICTIVE**

### **B. ENVIRONMENTAL GROUPS AND PUBLIC**

- o PROPOSED RULE DOESN'T CONSIDER FUTURE POPULATION GROWTH**
- o POPULATION DENSITY SHOULD BE SPECIFIED OUT TO 50 MILES**
- o EXCLUSION AREA OF 0.4 MILES IS TOO SMALL**
- o STATE SHOULD HAVE VETO ON SITING OF NEW NUCLEAR PLANTS**
- o DON'T REDUCE EXCLUSION AREA**
- o RULE WOULD ALLOW PLANTS NEAR HIGHER POPULATIONS**
- o 1979 TASK FORCE RECOMMENDATIONS SHOULD BE MADE MORE STRINGENT AND THEN ADOPTED**
- o SHUT DOWN THOSE PLANTS THAT CANNOT MEET THE 0.4 MILE EAB**

## **PROBLEMS WITH PROPOSED RULE**

- o VALUE FOR EAB BASED ON TID SOURCE TERM, AND CONSERVATIVE EVALUATION.**
- o CRITERIA FOR FUTURE REACTORS DON'T RECOGNIZE IMPROVEMENTS IN REACTOR SAFETY.**
- o ISSUANCE AS FIRM NUMBERS IN RULE IMPLIES GREATER IMPORTANCE THAN WARRANTED AND PROVIDES NO FLEXIBILITY.**

## **FUTURE ACTIONS**

- o STAFF COMPLETING EVALUATION OF COMMENTS.**
- o STAFF CONSIDERING ALTERNATIVES, SUCH AS**
  - STATING GENERAL OBJECTIVES FOR EXCLUSION AREA AND POPULATION DENSITY IN RULE, AND**
  - POPULATION DENSITIES TO REMAIN IN R.G. 4.7.**
- o PROPOSED FINAL RULE TO COMMISSION FEBRUARY 1994.**

**REVISION TO PART 100 APPENDIX A**  
**SEISMIC AND GEOLOGIC SITING CRITERIA**  
**FOR**  
**NUCLEAR POWER PLANTS**



## **OUTLINE**

- **WHY REVISION OF APPENDIX A IS NECESSARY**
- **OBJECTIVE OF PROPOSED REGULATION**
- **PUBLIC COMMENTS & ANALYSIS**
  - US GEOLOGICAL SURVEY COMMENTS**
  - FOREIGN COMMENTS**
- **PROPOSED HYBRID APPROACH**

### **WHY REVISION OF APPENDIX A IS NECESSARY**

- **APPENDIX A DOES NOT REFLECT THE ADVANCES IN SEISMOLOGY AND GEOLOGY SINCE 1973**
- **CONTAINS VERY DETAILED & PRESCRIPTIVE GUIDANCE ON MEETING THE REGULATION**
- **CONFLICTING INTERPRETATIONS OF APPENDIX A OFTEN LED TO TIME CONSUMING DISCUSSIONS AND ADJUDICATION BY THE LICENSING PANELS**
- **THERE HAVE BEEN DIFFICULTIES IN THE APPLICATION ARISING FROM THE MULTIPLE DEFINITIONS OF OPERATING BASIS EARTHQUAKE, E.G., FUNCTIONALITY, LIKELIHOOD OF OCCURRENCE, OR MINIMUM FRACTION OF SAFE SHUTDOWN EARTHQUAKE, 1/2 SSE**

### **OBJECTIVES OF PROPOSED REVISION**

- **DECOUPLE SITING REQUIREMENTS FROM DESIGN OR ENGINEERING REQUIREMENTS**
- **MOVE THE DETAILED GUIDANCE FROM THE REGULATION TO REGULATORY GUIDES**
- **UPDATE THE TECHNICAL REQUIREMENTS IN THE REGULATION TO REFLECT CURRENT KNOWLEDGE**
- **REDEFINE OPERATING BASIS EARTHQUAKE (OBE)\***
- **PROVIDE GUIDANCE ON RESTART FOLLOWING OBE TRIGGERED SHUTDOWN**

**\* IF OBE LESS THAN 1/3 SSE, NO ANALYSIS REQUIRED AND OBE IS INSPECTION LEVEL EARTHQUAKE.**

## **PUBLIC COMMENT ANALYSIS**

### **o UNITED STATES**

- SEVEN STATE GEOLOGICAL SURVEYS PROVIDED COMMENTS, MAINLY SUPPORTIVE OF DETERMINISTIC APPROACH**
- US GEOLOGICAL SURVEY RECOMMENDED THAT THE RESULTS OF THE PROBABILISTIC ANALYSIS BE CHECKED AGAINST A SIMPLIFIED DETERMINISTIC ANALYSIS**
- NUMARC/EPRI RECOMMENDED AN INTEGRATED PROBABILISTIC & DETERMINISTIC APPROACH WITH EMPHASIS ON PROBABILISTIC**
- NSRRC - USE OF PROBABILISTIC EVALUATION IS A STEP FORWARD, BUT ITS USE WITH THE TRADITIONAL DETERMINISTIC EVALUATION MAY BE A STEP BACKWARD**
- ASSOC. OF ENGINEERING GEOLOGISTS QUESTIONED MATURITY OF PROBABILISTIC EVALUATIONS**
- LIMITED COMMENTS TO DATE ON THE ENGINEERING PORTIONS, APPENDIX S OR THREE REG GUIDES**

## **PUBLIC COMMENTS (CONTINUED)**

### **o INTERNATIONAL**

- JAPANESE, FRENCH, TAIWANESE & CANADIAN UTILITIES (AS A GROUP REPRESENTED BY NEWMAN & HOLTZINGER) QUESTIONED THE REQUIRED USE OF PROBABILISTIC EVALUATIONS**
- ADDITIONAL COMMENTS FROM CANADA, SCOTLAND, ISRAEL, ITALY, KOREA  
- MIXED COMMENTS ON PROBABILISTIC ANALYSIS AND DETERMINISTIC DEFINITIONS**

## **PROPOSED HYBRID APPROACH - KEY ELEMENTS**

**CONDUCT PROBABILISTIC SEISMIC HAZARD ANALYSIS**

**CONDUCT SITE SPECIFIC AND REGION SPECIFIC GEOSCIENCE INVESTIGATIONS**

**CHECK TO DETERMINE IF GEOSCIENCE INVESTIGATION CHANGE PROBABILISTIC RESULTS**

**CALCULATE SITE SPECIFIC GROUND MOTION FOR PLANT**

**INDEPENDENT STAFF CHECK OF PROBABILISTIC RESULTS AGAINST SIMPLIFIED DETERMINISTIC ANALYSIS**

**ANPR ON SEVERE ACCIDENTS**  
**(PHASE II DECOUPLING)**

## **ANPR ON SEVERE ACCIDENTS (STATUS OF PHASE II DECOUPLING)**

- o ANPRM (SECY 92-292) ISSUED FOR COMMENT SEPTEMBER 28, 1992.**
- o COMMENT PERIOD EXPIRED DECEMBER 28, 1992.**
- o ACRS BRIEFED ON COMMENTS AND PROPOSED OPTIONS ON JUNE 10, 1993.**
- o COMMISSION PAPER PRESENTING COMMENTS AND PROPOSED OPTIONS.**



## **BACKUP VIEWGRAPHS**

## **SOURCE TERM ACCOMPLISHMENTS**

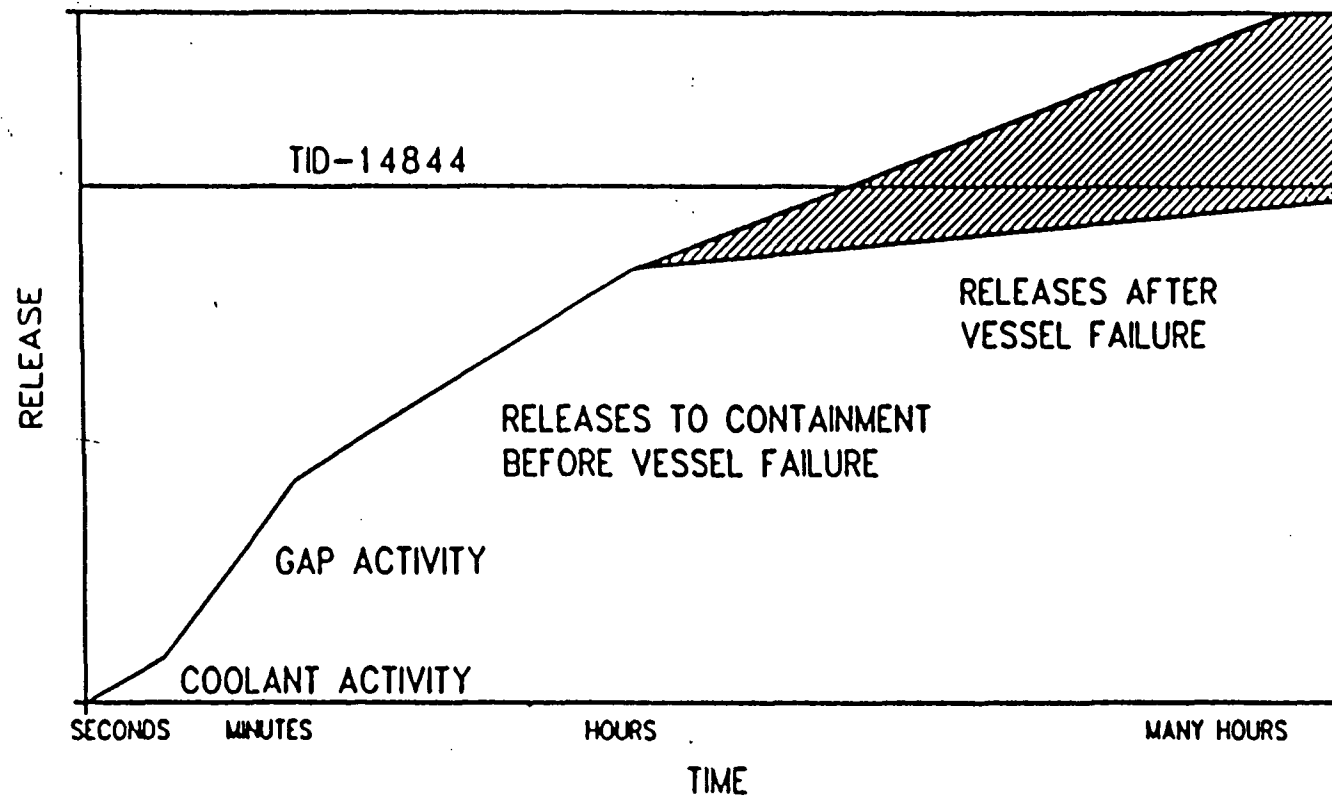
### **MODELS/ANALYSES**

- o TRAPMELT, VICTORIA - FISSION PRODUCT RELEASE AND TRANSPORT IN RCS
- o CORCON - RELEASE DURING CORE-CONCRETE INTERACTIONS
- o MAEROS - AEROSOL BEHAVIOR IN CONTAINMENT
- o TRENDS - IODINE BEHAVIOR IN WATER, ORGANIC IODINE BEHAVIOR
- o NAUA, SPARC, ICEDF - AEROSOL REMOVAL BY SPRAYS, POOLS, ICE BEDS

### **EXPERIMENTS**

- o PBF, FLHT, VI, ST TESTS - RELEASE FROM DEGRADED FUEL
- o NSPP, LACE, ABCOVE, MARVIKEN TESTS - AEROSOL BEHAVIOR
- o ACE-A, SURC, SWISS TESTS - CORE DEBRIS/CONCRETE INTERACTIONS
- o ACE-B, ORNL TESTS - IODINE CHEMISTRY
- o ACE-C TESTS - SOURCE TERM ATTENUATION BY SUPPRESSION POOLS
- o PHEBUS-FP TESTS - PROTOTYPIC TESTS TO CONFIRM RETENTION

# CONCEPT OF REVISED SOURCE TERM



**UPDATED SOURCE TERM COMMENTS SOLICITED FROM FOLLOWING**

DR. H. ALSMEYER, KfK, GERMANY  
DR. C. ALEXANDER, BATTELLE, US  
DR. L. BAKER, ARGONNE, US  
DR. E. BEAHM, OAK RIDGE, US  
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DR. D. BRADLEY, SANDIA, US  
DR. J. BROCKMANN, SANDIA, US  
DR. G. CENERION, IPSN, FRANCE  
DR. R. COLE, SANDIA, US  
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DR. A. VIKIS, AECL, CANADA  
DR. E. WARMAN, STONE & WEBSTER, US  
DR. R. WILSON, HARVARD, US

## INTERNATIONAL COMMENTS RECEIVED ON PART 100

- 0 BELGIUM
- 0 CANADA
- 0 FRANCE
- 0 GERMANY
- 0 INDONESIA
- 0 ITALY
- 0 ISRAEL
- 0 JAPAN
- 0 KOREA
- 0 SCOTLAND
- 0 TAIWAN