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NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS**

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COMMITTEE ON REACTOR  
SAFEGUARDS (ACRS)**

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July 12, 2000

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1 UNITED STATES OF AMERICA  
2 NUCLEAR REGULATORY COMMISSION  
3 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

4 \*\*\*

5 MEETING: 474TH ADVISORY COMMITTEE ON  
6 REACTOR SAFEGUARDS (ACRS)

7  
8 USNRC

9 11545 Rockville Pike, Room T2-B3  
10 Rockville, MD

11  
12 Wednesday, July 12, 2000

13  
14 The Committee met, pursuant to notice, at 8:30  
15 a.m.

16 MEMBERS PRESENT:

17 DANA A. POWERS, ACRS, Chairman

18 GEORGE APOSTOLAKIS, ACRS

19 JOHN J. BARTON, ACRS

20 MARIO V. BONACA, ACRS

21 GRAHAM WALLIS, ACRS

22 ROBERT SEALE, ACRS

23 ROBERT UHRIG, ACRS

24 THOMAS KRESS, ACRS

25 WILLIAM SHACK, ACRS

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## 1 PARTICIPANTS:

2 MOHAMMED SHUAIBI, DSSA

3 JOE WILLIAMS, DLPM

4 MIKE CHEOK, DSSA

5 DAVID MATTHEWS, DRIP

6 MR. BERGMAN

7 MARY DROUIN, PRA

8 TOM KING, OFFICE OF RESEARCH

9 MIKE SNODDERLY, NRR

10 ADRIAN HEYMER, NEI

11 BOB CHRISTIE, PERFORMANCE TECHNOLOGY

12 MR. PARRY

13 GERRY EISENBERG, ASME

14 SID BERNSEN, ASME

15 KARL FLEMING, ASME

16 MR. MARKLEY

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

[8:30 a.m.]

CHAIRMAN POWERS: The meeting will now come to order. This is the first day of the 474th meeting of the Advisory Committee on Reactor Safeguards. During today's meeting, the Committee will consider the following activities associated with risk-informing 10 CFR, Part 50: assessment of the quality of probabilistic risk assessments and proposed final ASME standard overall PRA quality. And we'll also discuss some proposed ACRS reports.

The meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Dr. John T. Larkins is the designated Federal official for the initial portion of the meeting.

We have received no written comments from members of the public regarding today's session. We have received a request from Mr. Bob Christie of Performance Technology, Incorporated, for time to make oral statements regarding risk-informing 10 CFR, Part 50. A transcript of portions of the meeting is being kept, and it is requested that speakers use one of the microphones, identify themselves, and speak with sufficient clarity and volume so that they can be readily heard.

We begin the meeting with some items of current interest. Members have a collection of reading. Here, I'll

1 call your attention particularly to a House Commerce hearing  
2 entitled "The Future of Nuclear And Coal Power." It  
3 provides some interesting reading.

4 Are there any other opening comments that members  
5 wanted to make regarding today's sessions?

6 Seeing none, I'll turn to the first item on the  
7 agenda, which is entitled "Activities Associated with Risk-  
8 Informing 10 CFR, Part 50."

9 Are you guys ready to go?

10 MR. SHUAIBI: Yes. Yes, we are. Good morning. My  
11 name is--

12 CHAIRMAN POWERS: The floor is yours.

13 MR. SHUAIBI: Good morning. My name is Mohammed  
14 Shuaibi. I'm from the Division of System Safety and  
15 Analysis. To my left is Mike Cheek, also from the Division  
16 of System Safety and Analysis. On my right is Joe Williams  
17 from the Division of Licensing Project Management. And, as  
18 you indicated, Mr. Chairman, we're here to talk about the  
19 risk-informed activities on Part 50 and specifically on  
20 Option 2.

21 The agenda for our part of the meeting is to go  
22 through the ANPR comments. Following that, we'll talk about  
23 preliminary safety views on industry guideline and PRA peer  
24 certification process. Then we'll talk about status and  
25 schedule items.

1           In response to the ANPR on Option 2, we received  
2 about 200 comments. The comments were related to four major  
3 categories: the approach that we proposed in the ANPR; the  
4 categorization; the treatment; and finally the pilot  
5 program.

6           Under approach, we thought there was general  
7 agreement on the list of rules that were identified in the  
8 ANPR, with a proposal to risk-inform them in a phased  
9 approach.

10           The phased approach would consist of risk-  
11 informing the special treatment requirements first. Those  
12 would be things like the EQ rules, and the requirements  
13 related to seismic qualifications and things like that.

14           A second phase would be administrative  
15 requirements, which would include recording and SR updates.  
16 And it was proposed that a separate, but parallel, effort  
17 address techspec rules and fire protection.

18           In addition, we were told to be performance-based;  
19 make sure that the rules are optional and that they allow  
20 for selective implementations for the rules and the systems  
21 at the plants.

22           CHAIRMAN POWERS: When we think about selective  
23 implementation, were the commenters thinking about selective  
24 implementation of aspects of a given rule or you could take  
25 one risk-informed rule and not another one? I mean -- how

1 option were they looking for you to be?

2 MR. SHUAIBI: Dick, I think the comments were  
3 mostly on a rule that they could pick a rule.

4 CHAIRMAN POWERS: Okay. But not parse it down any  
5 finer than that?

6 MR. SHUAIBI: I don't believe so.

7 CHAIRMAN POWERS: Yeah, okay. Mike, I imagine  
8 you're taking the 'chaos that would come about if you took,  
9 you know, 1.1 from a rule and said I'll take that one, but I  
10 won't take line 2. And I will take line 3, but not line 5.  
11 I mean, that would get complicated, I think.

12 I mean, some of them you could, I suppose, but--

13 MR. SHUAIBI: You know, the other part of selective  
14 implementation is by systems so that they could apply it to  
15 their different systems.

16 It was proposed that there be limited NRC prior  
17 review and approval. One of the commenters discussed a  
18 submittal that would identify the types of systems and the  
19 rules, and suggest a listing of the things that they would  
20 wish to implement at the plant. And that would suffice --  
21 as always recommended.

22 DR. WALLIS: Why do you have limited in there?  
23 Limited by what?

24 MR. SHUAIBI: In that we would be looking at the  
25 submittal be template type submittal that they would provide

1 the information in terms of the systems and the  
2 categorization that they're proposing. It's not a full  
3 review of the procedures and programs at the plant.

4 MR. CHEOK: Industry has used a matrix type  
5 submittal for risk-informed ISI, and they are proposing a  
6 similar type submittal for Option 2.

7 CHAIRMAN POWERS: Maybe you could elaborate on what  
8 you mean by a matrix type submittal?

9 MR. CHEOK: At this point, we are not really -- we  
10 haven't worked out the details as to what we want them to  
11 submit yet. And, as we go through the review, we'll have to  
12 come up with items which we feel are going to be important  
13 to our review and important to keep on the records as far as  
14 the submittal is concerned, and those are the items we will  
15 ask to be submitted to us.

16 MR. SHUAIBI: I guess as far as the proposal and  
17 the comment was -- it was suggested that a licensee would  
18 identify the regulations that they wish to adopt to risk  
19 inform methodology that's consistent with the requirements  
20 of 5069. They would identify how they meet what was  
21 proposed to be an industry guideline document, and anyplace  
22 where they deviate from that, they would discuss that, and  
23 that would be able to look at that.

24 We'd also provide a general schedule for  
25 implementation of the rules they chose.

1 Moving on to the last item it was suggested that  
2 we apply the back-fit rule to whatever results out of Option  
3 2.

4 CHAIRMAN POWERS: I guess -- I guess I don't  
5 understand that if the rules are optional, why should you  
6 have to apply the back-fit rule?

7 MR. SHUAIBI: The commenter suggested that -- for  
8 the Commission to fully understand what is being proposed  
9 that the back-fit process should be applied; that we need  
10 that in order to fully understand the rules being proposed.

11 CHAIRMAN POWERS: So what -- so what they're really  
12 asking for is you do a regulatory analysis?

13 MR. SHUAIBI: Yes. But we will always will do a  
14 regulatory analysis.

15 CHAIRMAN POWERS: Sure. I mean, I -- I would think  
16 you would always do that or at least you certainly could do  
17 that, but that's different from applying the back-fit rule?

18 MR. SHUAIBI: That's correct. The agency's  
19 practice in the past has not been to apply the back-fit rule  
20 on this type of rulemaking. But it's a comment we got.  
21 We'll address the comment.

22 MR. MATTHEWS: This is David Matthews from the  
23 Division of Regulatory Improvement Programs. We had a  
24 meeting on another occasion with that particular commenter,  
25 where this issue got raised in the context of a general

1 description of back fit. And I think this clarification was  
2 lost upon them: that the regulatory analysis, as you said,  
3 that will accompany the rule, you know, walks, talks, and  
4 pretty much looks like a back-fit analysis, except for the  
5 substantial additional protection criteria. The Commission  
6 has their -- in their discretion how much they view the  
7 value of such a rulemaking and the requirements suggested as  
8 to whether or not they'd like to adopt them as an  
9 alternative and that they would meet the adequate protection  
10 standard; therefore, be the minimal that needs to be imposed  
11 to provide an acceptable alternative.

12 So the Commission has that as a policy decision as  
13 opposed to the back-fit provision which would not allow us  
14 to "impose" something unless it had substantial additional  
15 protections. So, that distinction was discussed with that  
16 commentator -- commenter, and I believe they came away with  
17 a better understanding of the differences between a  
18 regulatory analysis and a back-fit analysis.

19 So, I think a response along those lines or what  
20 will be offered in the paper.

21 CHAIRMAN POWERS: Professor Seale?

22 DR. SEALE: Was there any comment made about the--

23

24 CHAIRMAN POWERS: Microphone, please.

25 DR. SEALE: I beg your pardon. Was there any



1 comment made about the time within which one an applicant  
2 would be expected to submit a proposal once they had  
3 indicated their intent to go to the risk-based or risk-  
4 informed approach and the coverage that they would be  
5 subject to during that transition period?

6 MR. SHUAIBI: I don't believe there was -- there  
7 were comments on the time in which they would have to  
8 submit. The comments on timing was to allow us sufficient  
9 flexibilities for -- flexibility for plants to implement  
10 this, since they're going to be doing, you know, the system,  
11 they want the rulemaking to allow for flexibility in the  
12 timing that they would complete the systems.

13 DR. SEALE: Okay.

14 MR. SHUAIBI: I don't believe there was anything on  
15 the timing that they would have submit.

16 DR. SEALE: Yeah. I can see someone saying, well,  
17 we're going to do this, but -- and then here you sit in  
18 limbo churning back and forth between them, and it strikes  
19 me as tying up some of the Commission's resources in the  
20 engineering assessment of the proposal -- just lack of  
21 precision and status, and, you know, all those dispersive  
22 things on the effort.

23 MR. SHUAIBI: In their application, it was  
24 suggested that they would give us a time frame for which  
25 they're going to complete it.

1 DR. SEALE: Okay.

2 MR. SHUAIBI: But that -- you know, other  
3 commenters, and I guess were to allow flexibility for that,  
4 recognizing that it's going to take a while to complete.

5 DR. SEALE: Yeah.

6 MR. SHUAIBI: The plant. Moving on to the next  
7 slide on categorization. We were told that they appendix T  
8 was unduly detailed, prescriptive, and burdensome. We  
9 should not identify consensus PRA standards as the only  
10 acceptable method for developing PRAs.

11 We should minimize the levels of risk  
12 significance, which would allow for functional  
13 categorization; that we should address the use of results  
14 from PRAs or tools with different levels of conservatisms  
15 and uncertainty.

16 And on this last one I believe the intent is that  
17 we don't mask the importance of a component from one PRA as  
18 a result of the uncertainty and conservatism in another PRA  
19 or another tool.

20 DR. SEALE: What does minimize the levels of risk  
21 significance mean?

22 MR. SHUAIBI: Currently, we're proposing a -- two  
23 levels of significance--safety significant and low-safety  
24 significant. That's what was proposed in ANPR. A question  
25 was asked as to, you know, whether we should expand that to

1 allow for more levels of risk significance; whether we  
2 should, you know, go -- South Texas, for example, used four.

3 DR. SEALE: I get you. Okay.

4 MR. SHUAIBI: And what they're saying there is--

5 DR. SEALE: It's -- I'm with you.

6 MR. SHUAIBI: Okay.

7 DR. SEALE: If no other questions, I'll move on to  
8 the next slide.

9 With regard to treatment, we were told that  
10 additional treatment for safety significant attributes  
11 should be determined by licensees and should rely on  
12 existing licensee programs; that commercial programs provide  
13 sufficient treatment for LSS, SSCs; that rulemaking should  
14 eliminate all existing commitments for LSS, SSCs; and that  
15 risk-informed change control process should be included in  
16 the rule.

17 DR. APOSTOLAKIS: Again, that's known as low safety  
18 significance, right? That's based on the importance  
19 measures?

20 MR. SHUAIBI: Of course, it's based on the  
21 categorization.

22 DR. APOSTOLAKIS: So some of them will be safety-  
23 related?

24 MR. SHUAIBI: Yes.

25 CHAIRMAN POWERS: Could be, yeah.

1 DR. APOSTOLAKIS: So the licensees -- I mean, the  
2 commenter is asking you to eliminate all commitments?

3 MR. SHUAIBI: That's correct. That mostly -- what  
4 we're talking about here is the Risk 3 Category, where you  
5 have safety-related components with previous commitments as  
6 a result of generic letters and information like that.

7 DR. APOSTOLAKIS: As I recall, the South Texas  
8 Project maintained some targeted QA requirements, right --  
9 for the safety related?

10 MR. SHUAIBI: That's right. Yes.

11 DR. APOSTOLAKIS: So this is more drastic?

12 MR. CHEOK: They are asking for more than is  
13 proposed by South Texas or by the ANPR.

14 DR. APOSTOLAKIS: Okay.

15 DR. SEALE: When a utility makes a request for a  
16 waiver, or an exemption, is that considered an existing  
17 commitment by the NRC or is that something else? In other  
18 words, this elimination of existing commitments, does that  
19 cut both ways?

20 MR. WILLIAMS: This is Joe Williams from the  
21 Division of Licensing, Project Manager. It's my  
22 understanding the staffs recently put out some guidance that  
23 draws a distinction between commitments and obligations.  
24 You know, an obligation is tied back to a regulatory  
25 requirement, whereas a commitment is essentially something

1 good or an improvement or an enhancement to your program in  
2 order to improve your compliance or to restore compliance  
3 with the regulations. So long as you are in compliance with  
4 the regulations presumably you can behave, you know, as you  
5 will -- you know, by any numbers of means that would comply.  
6 You know, there's a guideline document that describes how  
7 various licensees can manage their commitments, and they are  
8 free to change those without prior notification or approval  
9 of the Commission.

10 DR. SEALE: The thought of edification on the  
11 distinction makes me tremble.

12 MR. BERGMAN: It doesn't mean we agree with the  
13 comment. We're just reflecting the comments here. Their  
14 concern on this is they have -- they -- there is a  
15 commitment management guideline, but they don't want to go  
16 through that guideline for each specific commitment and  
17 change, because of the sheer large number. On the other  
18 hand, when we're talking about commitments, that is, those  
19 things not tied to rules, that's really outside the scope of  
20 a rulemaking. We've discussed it with NEI at a meeting a  
21 couple weeks ago, and they appear to be inclined to modify  
22 their commitment management guideline to allow this process  
23 to take place, because there -- there is not even a reg  
24 guide endorsing that commitment management guideline. It's  
25 just a letter. But that's their concern. They have all

1 these commitments on the book. They wanted us to treat it  
2 under rulemaking, and it really doesn't fit under  
3 rulemaking.

4 DR. UHRIG: The risk-informed change process, are  
5 they referring to 10 CFR 5059, or is this an alternative  
6 process?

7 MR. SHUAIBI: This is in recognition that 5059 is  
8 not adequate for things that are beyond the design basis  
9 that would be identified by this process, by the risk-  
10 informed process. In other words, you could apply -- you  
11 could use 5059 -- ask the questions on 5059 on things that  
12 are beyond the design basis and not trigger the criteria.  
13 So you'll need something else in place to make sure that,  
14 you know, it establishes a threshold for where they would  
15 have to come in for review or what they would be allowed to  
16 do. 5059 operates on the design basis, and this is to make  
17 sure that we have a risk-informed version if you will built  
18 into the risk-informed option.

19 Okay, moving on to the next slide then. For pilot  
20 programs, we were told that the final rule should not be  
21 back fit on pilot plants with reviewed and accepted  
22 processes; and that South Texas project has demonstrated the  
23 risk-informed process for many different types of systems  
24 and components; and that there is no need to include strict  
25 requirements for other pilot plants to do so. In this case,

1 in ANPR, we had mentioned that a pilot plant would have to  
2 do mechanical, electrical, passive, active components, and  
3 they were saying, well, South Texas has already demonstrated  
4 the viability of the risk-informed process for these. There  
5 is no need to do it again.

6 CHAIRMAN POWERS: And what's your impression?

7 MR. SHUAIBI: Actually, we don't have answers yet.  
8 We're just presenting the comments, and we're working on the  
9 responses.

10 CHAIRMAN POWERS: In thinking of a response to  
11 this, how do you think about it?

12 MR. SHUAIBI: In thinking of a response to this,  
13 how I think about it? Well, I think we need to pilot our  
14 process--the categorization that we are coming up with. So  
15 we have to make sure that the process that we're using for  
16 the rulemaking is -- will work.

17 MR. WILLIAMS: Presently, I think we're at a bit of  
18 a disadvantage in that we haven't actually seen the formal  
19 submittals of the nature of the pilot programs, and so we  
20 really can't say whether or not it's going to be  
21 satisfactory to the rulemaking project or not.

22 CHAIRMAN POWERS: Okay.

23 H: And that means you've come to the conclusion  
24 you're going to maintain your categorization process rather  
25 than endorse an industry-proposed one?

1 MR. SHUAIBI: I think in terms of Appendix T and  
2 what was proposed in ANPR, the comments, at least most of  
3 the comments, were to the effect of you don't need that  
4 level of detail in the rule; that you would take that detail  
5 and put it in an industry document, which you could endorse.  
6 So I believe it probably would be close. It's not going to  
7 be--

8 MR. CHEOK: As a matter of fact, Dr. Shack, NEI has  
9 come in with a document on categorization that we are  
10 looking at right now, and that document in many respects  
11 conforms to the level of detail that's found in Appendix T  
12 right now. Their comment was that we do not need that kind  
13 of detail in the rule, but somewhere else maybe.

14 MR. SHUAIBI: Part of that comment is so that they  
15 can take advantage of advances in technology without having  
16 to come in for rule -- without having to go through  
17 rulemaking. They want to be able to do that by changing a  
18 guidance document instead of a rule. So--

19 DR. APOSTOLAKIS: Wasn't it -- a related --  
20 somewhat related comment, which I don't see here that  
21 Appendix T should really be a regulatory guide to allow more  
22 flexibility in -- to change it in the future?

23 MR. SHUAIBI: Yes, that's the comment about having  
24 too much detail in the regulations. The comment there was  
25 take the details, put them in a reg guide or guidance



1 document developed by industry which can be endorsed by a  
2 reg guide. So you're moving the details from the  
3 regulations themselves to a reg guide in effect.

4 DR. APOSTOLAKIS: So you're thinking about it?

5 MR. SHUAIBI: Yes, we are.

6 Okay, if I have no other questions, I'll turn it  
7 over to Joe Williams, who's going to talk about the next  
8 slide.

9 MR. WILLIAMS: This next slide merely lists some of  
10 the documents we've received recently--the guideline  
11 documents that the Nuclear Energy Institute has developed  
12 for the implementation of Option 2. We just note that we  
13 received the categorization draft back in March. The  
14 proposed guidelines for the peer certification in April.  
15 And recently received the treatment guidance.

16 All three of these documents we've discussed our  
17 preliminary impressions in public meetings. It's our intent  
18 over the next couple of months to provide more formal  
19 comments and to interact with the stakeholders as we, you  
20 know, work towards finalizing these documents.

21 Mike Cheek is going to discuss the categorization  
22 and the peer review aspects, and then I'll come back for the  
23 treatment portion.

24 MR. CHEOK: First, I guess, I'm going to talk about  
25 the industry peer certification process. This is the

1 document called NEI 000-02, and it is the document that is a  
2 take off of the previous BWR owners' group, PRA  
3 certification process, which I guess -- I believe has been  
4 discussed with the Committee before.

5 To review NEI 000-02, the staff has come up with a  
6 process which consists of four tasks, and I guess the Office  
7 of Research and NOR are both working on these four tasks.

8 The first task is basically a process review.  
9 What we're going to do is look at the overall process to see  
10 if the process conforms with what the staff expects of a  
11 peer review type process.

12 We also will look at the definition of PRA  
13 quality, and if this process will conform to Section 2.5 of  
14 REG Guide 1.175 -- 1.174 in terms of what we expect of the  
15 quality of the PRA.

16 In Task Two, this is mostly a Office of Research  
17 Task. Task Two is a review of the technical elements and  
18 requirements of the peer review process. The first subtask  
19 here is to review the high-level requirements. I believe  
20 the higher-level requirements were discussed with this  
21 Committee again in the past month. We are writing a SECY  
22 paper to the Commission on how we're going to look at PRA  
23 quality. And an attachment to this SECY paper is -- lists  
24 the high-level requirements of what we think the minimum a  
25 PRA should look like for it to be a PRA.

1           So the first subtask is to review the 209 elements  
2 in the certification process to see if they conform to our  
3 high-level expectations.

4           The second subtask here is to look at the sub-  
5 tier criteria. The industry has submitted a list of sub-  
6 tier criteria for each of these 209 elements to see how each  
7 of these elements are being supported. We will review these  
8 sub-tier criteria against staff -- currently available staff  
9 documents, including the ASME PRA standards and other NUREGS  
10 and reg guides that we currently have to see if this  
11 certification process conforms to the expectations as we  
12 have -- as we currently have.

13           I guess a big part of this sub-task is to list any  
14 differences, and if these differences will affect Option 2  
15 applications; in other words, differences will not be a  
16 showstopper, we just need to know if the differences will  
17 actually make a difference in the application.

18           The next subtask is to review basically the Option  
19 2, Appendix T requirements. NEI has asked us to review this  
20 certification process in conjunction with the Option 2  
21 Process itself, and I think we agree with them that a PRA  
22 should be reviewed -- PRA quality should be reviewed in  
23 conjunction with the applications it's being used for.

24           So, in this case, what we're trying to do is to  
25 define the decision to be made; define the decisionmaking

1 process, specifying the role of PRA results; in other words,  
2 how the results will be used, and in what context they'll be  
3 used in. And identify what we need from the PRA to give  
4 confidence that the conclusions will be robust.

5 So basically, what we're doing is we're looking at  
6 Appendix T and the industry guidance documents and judging  
7 the requirements there against what is needed in NEI 000-  
8 02. Note that in Appendix T and in the whole Option 2  
9 process, we have other requirements -- what we call the  
10 backstops. And they can only do so much. They still have  
11 to maintain functionality; in other words, the extent of the  
12 change is limited. We are also asking for other factors,  
13 such as defense in-depth, safety margins we maintained. So  
14 these are the factors we have to take into account when we  
15 review the elements in NEI 000-02.

16 Also part of -- of Task 3 is to I guess identify  
17 compensatory measures that the licensee could take in cases  
18 when their PRA is not conforming to the certification  
19 process. In other words, if the certification process calls  
20 for certain elements of, let's say, HRA or data analysis,  
21 and the licensees do not conform to these elements, we are  
22 trying to identify sensitivity studies would be sufficient  
23 to get around these non-conformance or these standards  
24 practices.

25 As Task 4 to this review, we will try to define

1 the documentation requirements that the licensee has to  
2 submit to the NRC for -- to get a better feel as to what  
3 went on in the certification process; what the review  
4 findings were; and how these review findings will be taken  
5 into account in the application.

6 CHAIRMAN POWERS: Sooner or later, I -- the  
7 certification of PRA is going to become a fairly geriatric  
8 thing; that is, it gets done here. A guy has supplied a PRA  
9 that is good for certain kinds of applications; and that  
10 certification, you know, will get one, two, five, ten years  
11 old. Does it good any good then to look at what the  
12 findings of a 10-year-old review are?

13 MR. CHEOK: No, it doesn't. And I think we will  
14 discuss that a little bit in the next slide.

15 I think we believe that, you know, the  
16 certification will probably be done once. We believe that  
17 when there are major updates to the PRA, it needs to be  
18 redone at least for the parts that were updated. And I  
19 believe that there should be sufficient documentation of the  
20 review findings that will apply, independent of the  
21 application in the future, because when we -- when most of  
22 these certifications are done, there's no application in  
23 mind so to speak.

24 CHAIRMAN POWERS: That's right. The certification  
25 has done kind of a generic thing. They don't -- nothing

1 really specific to look at.

2 MR. CHEOK: Well, the certi -- the certification  
3 process, as defined right now, has got four grades, and they  
4 have four general types of applications that are applicable  
5 for each grade. But we believe that even within each grade,  
6 it could be quite different for a specific application.

7 On the next slide, what we're saying here is that  
8 we will review the sub-tier criteria. Although the NEI has  
9 submitted a sub-tier criteria, they had asked us not to  
10 review them. There are just for our information purposes  
11 only.

12 In our letter back to NEI, we stated that we will  
13 need to review the sub-tier criteria because the grading of  
14 the elements will almost be impossible unless we look at a  
15 sub-tier criteria.

16 The second bullet on this page basically brings up  
17 your point, Dr. Powers, in the fact that we need very well  
18 documented peer review results for these peer reviews to be  
19 applicable to future applications, because these results  
20 will be used by the expert panel to deliberate what is  
21 safety significant and what isn't. For example, a grade 3  
22 type PRA is defined as, you know, you shall -- you should  
23 meet certain requirements, but if you don't meet those  
24 requirements, you should have justified reasons. We would  
25 like to know whether you meet those requirements or if you

1 have justified reasons. If you have justified reasons, we  
2 would like to know if these justified reasons are affected  
3 by the application. Not only we, the staff, but I think the  
4 expert panel should know this kind of information. And,  
5 again, if the PRA gets updated in the future or if the  
6 application changes, I think these kind of documentation is  
7 important. And we are in the process of trying to define  
8 how or what level of documentation would be required by this  
9 certification process.

10 The third bullet also applies to what you asked  
11 earlier. Many of these -- most of the BWRs have been peer-  
12 certified already. Many PWRs are being peer certified. A  
13 lot of these reviews have gone on without the benefit of the  
14 sub-tier criteria--of the written sub-tier criteria. I  
15 mean, this criteria existed in the reviewers', I believe,  
16 minds. But -- so we are trying to define how we can, I  
17 guess, grandfather PRAs that have been peer reviewed  
18 already.

19 The staff has attended two previous peer review  
20 certifications. We plan on going to a couple more in the  
21 near future. We plan on reviewing documentation of several  
22 that has been done. And we also plan on looking at the  
23 results of this peer review and the pilot applications in  
24 Option 2, and how the results of this peer review are being  
25 taken into account in the pilot applications.

1 I guess we will try to come to a conclusion as to  
2 how we can treat this grandfathering of the previous peer  
3 reviews.

4 And last, the last item on this slide is the  
5 Expert Panel or the Independent Decisionmaking Panel.  
6 Obviously, we are entrusting a big responsibility to this  
7 panel. And we would like to define -- a more defined  
8 process as to how this panel is going to take into account  
9 all the peer review comments.

10 Can I have the next slide, please? In summary,  
11 basically, what we're looking for in the peer review process  
12 is to get confidence in the PRA. And we can get confidence  
13 in the PRA by getting confidence in the peer review process  
14 and how the licensee dispositions this, the peer review  
15 comments, and how the results of the disposition and the  
16 results of the PRA themselves are being used in the  
17 application.

18 As Joe mentioned earlier, NEI has also submitted a  
19 guidance document on how you categorize SSCs. This was done  
20 in March. Our comments on this document was that it was on  
21 basically the scope and quality of the PRA, how they treat  
22 it. And as a result of this comment, they indicated that  
23 they would submit NEI 000-02 as part of the quality process.

24 As far as scope process is concerned, I guess they  
25 agreed with the staff that we will require a level 1 at



1 power PRA, and that we shall treat external events and low-  
2 power and shutdown by a PRA if available. If not, we can  
3 use processes such as the seismic margins process or the  
4 five process for fires or maybe the NUMAR 91.06 for low  
5 power and shutdown. Again, I guess on the third bullet  
6 here, a lot of these things now relies on the Expert Panel.  
7 When you don't have the PRA, what kind of requirements, what  
8 kind of guidelines do we have to give to the Expert Panel  
9 absent a PRA?

10 We believe that absent a PRA, you need to make  
11 more conservative decisions, and we are in the process of  
12 defining how you can come up with these more conservative  
13 decisions if you do not have the PRA.

14 We also discussed the role of importance analyses  
15 and the role of the quantification of risk and the role of  
16 sensitivity studies in bounding this risk if you cannot  
17 define the effect, the cost effect, of the application on  
18 the SSC -- on the PRA elements.

19 The last thing we discussed with industry as far  
20 as categorization is concerned is the role of monitoring and  
21 feedback. You know, is making it through monitoring enough?  
22 How do we update the PRA from this monitoring?

23 And I guess the next slide, I'll -- for the next  
24 slide, I'll turn it over the Joe Williams.

25 MR. WILLIAMS: Thank you, Mike.

1           These topics here, on this slide, are some of the  
2 thoughts that the staff shared with NEI regarding the draft  
3 treatment guideline at a meeting a couple of weeks ago.

4           The first bullet is really one of the basic keys  
5 to the whole process. Commercial practice is a term that's  
6 used somewhat loosely, I think. It covers a very wide range  
7 of activities. An analogy I've used a couple of times is  
8 the difference between a Rolls Royce and a Yugo. We need -  
9 - the staff, that is needs a thorough understanding of what  
10 processes will be applied, and how we're going to gain an  
11 adequate assurance that you're going to have commercial  
12 practices fulfilling an adequate standard for the  
13 application. It is proposed that commercial practices will  
14 be applied both to the RISC-2 components and to the RISC-3  
15 components. Those both have differing end use, if you will.  
16 That is, that in one case we're looking to preserve the  
17 existing deterministic design basis. In the other case, we  
18 want to be sure that the components will be able to fulfill  
19 their safety function as determined by the risk  
20 categorization process.

21           The next bullet addresses the question of the  
22 preservation of the existing design basis. We can't do  
23 anything to compromise the existing design basis under  
24 Option 2. Change control is a topic we had touched on  
25 earlier. We'd had the question regarding the risk-informed

1 change process. As was noted, 50.59 is not an adequate tool  
2 for this function. NEI has agreed with us that such a  
3 change process would be necessary to put in place. We still  
4 some additional details on what the actual construction  
5 would be for such a process.

6 The last two bullets, again, get back to the  
7 commercial processes, and the commercial practices. Again,  
8 fundamentally, how did the commercial practices and the  
9 monitoring under normal operating conditions give us the  
10 confidence or the capability for the design basis and the  
11 confidence and the capability for a risk-significant  
12 function?

13 Questions?

14 MR. SHACK: What is preservation of the design  
15 basis mean in this sense? I mean, you're obviously changing  
16 the design basis when you're recategorizing the safety-  
17 significant components and changing their treatment. Is it  
18 preservation of functionality that was assumed?

19 MR. WILLIAMS: It's -- you know, that -- in this  
20 case, it would be that the functionality assumed by the  
21 deterministic design basis is not compromised. More  
22 specifically, I should clarify that: that we still have an  
23 adequate assurance, albeit at a low level -- lower level of  
24 the functionality.

25 Anything else?

1           Presently, the staff is developing some guidance  
2 for the review of the South Texas exemption. We expect that  
3 this guidance will be developed into the Option 2 acceptance  
4 criteria that we'll be using to assess the guidelines  
5 provided to us by NEI. As a result, it's important for the  
6 staff to understand how the STP and the NEI proposals are  
7 similar and also how they're different.

8           It's -- in my mind, it's okay if they're different  
9 so long as we can thoroughly discuss those differences and  
10 assess those differences and can describe those differences  
11 and incorporate whatever information is necessary from both  
12 activities into our final rule.

13           This last slide discusses our present schedule for  
14 the Option 2. Coming up in late August, we're going to be  
15 sending forward a Commission paper discussing the ANPR  
16 comments, our initial reaction to those comments when that's  
17 available, and also describing some of the issues that are  
18 before us for Option 2. We'll be coming back to this  
19 Committee about that time frame is my understanding to  
20 discuss the content of that paper. Following that time,  
21 we'll be conducting a Commission briefing.

22           The pilot program should be initiating about in  
23 the same time frame. It's my understanding that the boiling  
24 water reactors are proceeding ahead of any of the other  
25 owners' groups at this time. However--

1 CHAIRMAN POWERS: Would you explain to me again --  
2 pilot program for what?

3 MR. WILLIAMS: This is the pilot program for the  
4 Option 2.

5 CHAIRMAN POWERS: And this is the one where you --  
6 it's been suggested that you not have a pilot program? Was  
7 it the one?

8 MR. WILLIAMS: It wasn't suggested--

9 CHAIRMAN POWERS: Everything from South Texas?

10 MR. WILLIAMS: To clarify the earlier comment, it  
11 wasn't suggested that we not have a pilot program. It's my  
12 understanding of the comment that the staff had put forward  
13 some thoughts about the scope of systems and the types of  
14 systems that would be necessary for a thorough pilot. The  
15 commenter, as I understand it, basically said, you don't  
16 need to do -- to be as comprehensive as the staff had  
17 proposed, though, nonetheless, it would be useful to have a  
18 pilot process. And, indeed, to my mind, it's essential  
19 because South Texas hasn't taught us anything at this point  
20 about how good a job the NEI guideline and the guidance that  
21 the staff has put forward does for the categorization and  
22 treatment.

23 The South Texas process was developed before any  
24 of these documents were on the street.

25 CHAIRMAN POWERS: One of the questions I have --

1 always have about pilot program. We're only pilot it for a  
2 plant or two or three plants even. Is there particular  
3 samples out of a bigger population. How do you interpret  
4 findings for a plant or even two or three plants in terms of  
5 that bigger population? That is, they come back and say you  
6 -- this part of the program's fine. It worked easily and  
7 what not. But it's for them. And it may not work so well  
8 for another type of plant or another ownership plant;  
9 another way of managing the plant.

10 Conversely, things that prove to be very  
11 difficulty and thorny for a particular plant may be easy.  
12 How do you know that?

13 MR. WILLIAMS: I think that's part of the reason  
14 that the staff had originally proposed the kind of  
15 comprehensive program that we're talking about. We hadn't  
16 really planned to go to a large number of facilities. We  
17 were only looking at on the order of four to six facilities  
18 was what we thought would be a manageable number. But, when  
19 we looked at those, we wanted to get a variety of vintages  
20 of plants--you know, early licenses, late licenses,  
21 different types of reactors--pressurized and boiling water  
22 reactors--in an effort to try and exercise the process as  
23 thoroughly as possible to bring forward any of those  
24 problems that you described.

25 MR. BERGMAN: Again, this is Tom Bergman. The

1 benefit you get from the pilot is it allows you to get -- to  
2 learn a lot before you go to final rulemaking. And, yeah,  
3 you're not going to have complete knowledge. I mean, you  
4 still may learn things after you've gone to final  
5 rulemaking; that you always take the chance you'll need to  
6 modify the rules or certainly the guidance documents as you  
7 go into full implementation. But it does give you some  
8 information as to how good your proposed rules and  
9 implementation guidance are very early in the process. But  
10 we can't implement the rules before we write them across the  
11 board. So it's the trade-off. We're just making a trade-  
12 off there. You're trying to gain some benefit at a small  
13 number of sites before you make the rules final.

14 CHAIRMAN POWERS: I'm just trying to understand how  
15 one can judge whether you're sampling should be a single  
16 plan, two plans, or more diverse sampling--age, type,  
17 vendor, what not that you were talking about. I don't --  
18 clearly, you must get better information when you look at a  
19 -- at six plants that are different -- that differ by age of  
20 their license, type of -- power plant type of containment,  
21 type of management than you do with one or six of particular  
22 kind. But I'm trying to get some idea how big the advantage  
23 it is to do one kind of sampling versus the other.

24 MR. BERGMAN: I don't think we have data where we  
25 can quantify that. We've traditionally tried to get a

1 spectrum of vendors and vintages of plants based on the  
2 intuition that the more diverse the facilities participating  
3 in the pilot, the more different information you'll gain  
4 from it. But it's -- we worked that within it. We can't  
5 make a plant be a pilot. It's a voluntary effort, and so we  
6 work that through with industry in terms of what's the  
7 appropriate scope. And we are waiting. NEI is trying to  
8 coordinate for all the owners group to come up with a  
9 specific proposal in terms of the number of facilities  
10 within each vendor group. And they just can't hand us and  
11 say, we want, you know, you to do 16 plants. We may say,  
12 we'll eight is sufficient. There is an agreement we work  
13 out there in terms of the scope of the pilot program.

14 MR. WILLIAMS: Certainly, again, to reiterate what  
15 Tom was saying because we're dealing with volunteers, we're  
16 certainly dealing with people that are very interested in  
17 making the process work.

18 CHAIRMAN POWERS: Sure. Sure. There's--

19 MR. WILLIAMS: And so, as a result, you know, there  
20 -- arguably there would be a natural bias towards not  
21 identifying problems perhaps.

22 CHAIRMAN POWERS: Yeah, it makes things work  
23 smoothly and what not.

24 MR. WILLIAMS: But I think, you know, really we  
25 can't speculate too much just because we don't know the



1 nature of the facilities that we're going to be dealing with  
2 and we can't say what kinds of problems are going to be  
3 turned up, either at the pilot stage or in the full  
4 implementation stage.

5 I guess the remainder of the slide just outlines  
6 some of the larger milestones for the overall rulemaking  
7 activity. You'll note the end of this year we plan to have  
8 the acceptance criteria that I had alluded to earlier that  
9 should be developed out of the criteria we're developing for  
10 the South Texas review. Ultimately, we should be taking the  
11 final rulemaking to the Commission December 2002 per our  
12 current schedule.

13 CHAIRMAN POWERS: When do you decide how long to  
14 run the pilot?

15 MR. WILLIAMS: I guess, you know, the first thing  
16 we want to do is thoroughly exercise the categorization  
17 process. That does not mean that you would exercise it for  
18 all systems at a plant, but hopefully, again, at a variety  
19 of systems. You may be looking for combinations of  
20 information from different facilities. It's our expectation  
21 that after a facility is put in place their categorization  
22 process and has started running through some systems that  
23 they would come forward for an exemption similar to what  
24 South Texas has done, proposing -- saying that they're doing  
25 the treatment according to the guideline that we've -- are

1 reviewing; that they're proceeding with treatment consistent  
2 with the guidelines that we're reviewing; and that we should  
3 authorize an exemption for them that as they take systems  
4 through the process, they can move them from the existing  
5 special treatment requirements into the new Option 2 special  
6 treatment requirements. So it would be -- I guess we're  
7 looking for a time frame where your categorization processes  
8 or the -- and treatment processes would be put in place, but  
9 the full implementation would probably be some time down the  
10 road. You know, we would hope that we'd gain the lessons  
11 learned that we were talking about earlier much sooner in  
12 the process when you -- basically, as you go through the  
13 first few systems with your categorization and treatment.

14 CHAIRMAN POWERS: Well, it looks like a lot of --  
15 an awful intense period of time, because if you get the  
16 pilot program started by January of 2001, which seems to me  
17 about as soon as you can really start doing the pilot  
18 programs because you still go to -- you have to identify the  
19 plants. You have to get them to volunteer. You have to  
20 explain to them what it is, and you don't have the final  
21 acceptance criteria until December. So it looks to me like  
22 January is about when the things start, and you got about  
23 six months of time before you have to have the proposed  
24 rulemaking up to the Commission.

25 MR. BERGMAN: That was our assumption. But

1 industry has indicated they're going to initiate the pilot  
2 program before we have the acceptance criteria developed.

3 CHAIRMAN POWERS: Okay.

4 MR. BERGMAN: They have some confidence in their  
5 documents, and they will proceed. They're already, through  
6 the owners' groups, identifying the plants. I mean, the  
7 pilot -- it depends on when you say it starts. And to a  
8 certain extent, it's already started in terms of getting  
9 people to be pilots.

10 CHAIRMAN POWERS: Okay.

11 MR. BONACA: I have just have a question regarding  
12 in selecting pilots, are you going to look for different  
13 level of details in the PRAs that support these pilots.  
14 Expect an understanding of what's the minimum level of  
15 detail that you would want to have.

16 MR. WILLIAMS: The peer certification process  
17 should define the minimum level of information that's  
18 provided in the PRA. As Mike was stating earlier, there are  
19 number of attributes that are characterized by the sub-tier  
20 criteria that would be expected to be in place for any PRA  
21 tool that was used for this application. And then the so-  
22 called grade 3 would be the default minimum level of  
23 conformance to that criterion or to a given criterion.

24 MR. BONACA: But you'll do some verification of  
25 that through your pilots?

1 MR. WILLIAMS: It would be my -- yes.

2 MR. BONACA: And, okay.

3 MR. WILLIAMS: Are there any other questions?

4 Well, this concludes our presentation. Thank you,  
5 gentlemen, for your time.

6 CHAIRMAN POWERS: You're next. You'll be happy to  
7 know, Mary, that we're always happy to have you come before  
8 us. You're an acknowledged expert. We always learn  
9 something when you come.

10 We go now from Option 2 to Option 3, is this what  
11 happens here?

12 MS. DROUIN: Yes.

13 CHAIRMAN POWERS: It's strange to call these  
14 options still. You know, when you offer the Commission  
15 Options 1, 2, and 3, and they say, yes. I think we ought to  
16 take the word option off.

17 MR. KING: But everybody knows what it means in a  
18 very short-hand way.

19 CHAIRMAN POWERS: I've just got to ask, Mary, is  
20 this what they mean when they say General Drouin and her  
21 troops? Are these the troops?

22 MR. KING: She didn't answer that question.

23 MR. BARTON: That's a loaded question.

24 MR. KING: Alright, for the record, my name is Tom  
25 King from the Office of Research. With me at the table is

1 Mary Drouin, the PRA Branch and Research; and Mike Snodderly  
2 from NRR.

3 We have two topics we were going to cover: a brief  
4 summary of what we call the framework for Option 3, and then  
5 a discussion of where we stand on applying that framework  
6 for 50.44, the Combustible Gas Control Rule, focused on what  
7 recommendations we're coming up with that we're planning to  
8 go the Commission in an August SECY paper, and also talk  
9 about some of the issues that come out of this.

10 I know we spent yesterday at the Subcommittee  
11 discussing the framework, so maybe we can move through that  
12 fairly quickly, and then get to 50.44, which we had talked  
13 to the Subcommittee about -- I don't know -- several weeks  
14 ago. But it may be worth spending more time on that today.  
15 So, Mary?

16 MS. DROUIN: Thank you, Tom. These viewgraphs are  
17 going to look very familiar. Again, you know, we -- in  
18 looking at Option 3 and to risk-inform the regulations, we  
19 started off where we felt like we needed to build a  
20 framework for the staff use to help guide us in making our  
21 decisions on how to risk-inform the regulations as we go  
22 through them.

23 So, of course, the frameworks applied to the  
24 regulation. It's also meant to help us, you know, with all  
25 the implementing documents--the regulatory guidance, et

1 cetera, plan to the DBAs, you know, to help us screen and  
2 formulate the technical requirements. In building the  
3 framework, we took what we call a risk-informed defense-in-  
4 depth approach. And as we walk through the next set of  
5 viewgraphs hopefully we'll be able to clarify what we mean  
6 by this risk-informed defense-in-depth approach.

7 At a high level, what we're trying to say is that  
8 it's based on what we call these prevention and mitigation  
9 strategies which were derived from the reactor safety  
10 cornerstones and trying to stay consistent with those.

11 In implementing the strategies of prevention and  
12 mitigation, we have these various tactics that will help us  
13 in determining the design and operational requirements as  
14 need be. And we're going to get into that a little bit more  
15 in the slides.

16 Also, the framework is considering both design  
17 basis and severe accidents so that we cover any risk  
18 significant accidents that could be a safety challenge.

19 So we start off with our two high-level strategies  
20 of prevention and mitigation. And we are dealing with core  
21 damage here when we're talking about the reactor. And in  
22 looking at the prevention, we're trying to deal with  
23 limiting the frequency of the events associated with your  
24 accidents or limiting the probability of your core damage  
25 given that you have the event.

1           On the mitigation side, it's breaking down to its  
2 two strategies: limiting the releases given that you have a  
3 core damage, and then given that you have a containment  
4 failure, and you have some releases to limit the public  
5 health effects derived from these.

6           DR. WALLIS: Mary, this sounds very good. If you  
7 were designing regulations, again, from scratch, you would  
8 have to make them meet all these objectives.

9           MS. DROUIN: Correct.

10          DR. WALLIS: You're going to show us how these  
11 ideas apply to the spaghetti of regulations which exists.  
12 It seems to me that it's not clear that they map onto this  
13 kind of way of thinking.

14          MS. DROUIN: Well, I'm not going to--

15          MR. KING: Yeah, but I think the idea of this way  
16 of thinking is a good way to look at the--

17          DR. WALLIS: Well, if you--

18          MR. KING: Spaghetti of regulations and see--

19          DR. WALLIS: But it's not clear that there's a  
20 compatibility between--

21          MR. KING: Well, that's part of what we're doing in  
22 Option 3 is to see, you know, should we make changes to make  
23 them compatible.

24          DR. WALLIS: That is the problem, isn't this the  
25 real tough nut?

1 MR. KING: That's a tough nut.

2 MS. DROUIN: One of the slides I don't have here is  
3 that in SECY 00-86, in the framework document you have, and  
4 we talked a little bit about this yesterday at the  
5 Subcommittee is that we did -- we have taken a quick course  
6 look at the regulations against these strategies. I mean,  
7 we went into the PRAs and we stood back and said, okay, from  
8 the body of the PRAs, what are the insights we're getting  
9 out in terms of what are all the dominant accident classes  
10 and contributors that are a safety concern that the PRAs are  
11 telling us about. And then we tried to look at those and  
12 match those up to the regulations. So that a high level,  
13 the course level, was there something that the regulations  
14 were missing. We're just right now getting into that part,  
15 so we don't really have a whole lot to say on that aspect,  
16 because it's going to be a little bit more complicated than  
17 that. But we have started down that path.

18 Third, the prevention and mitigation strategies,  
19 the four strategies there. We have tactics to help  
20 implement these strategies or help guide us on them. And,  
21 at this level, you have tactics what we call that are both  
22 dependent on risk insights and not dependent on risk  
23 insights.

24 And when we say not dependent on it, what we mean  
25 is that regardless of what your PRA may say, these are



1 things that we're going to stay with. You know, such as --  
2 you know, the use of good engineering practices,  
3 maintaining your same level of protection against your  
4 anticipated operational occurrences. We will have three  
5 barriers to radionuclide release. We will always have  
6 emergency planning. So there's such things again, and these  
7 are some examples--things that we will maintain regardless  
8 of your risk insights.

9 DR. WALLIS: Well, I wonder if it's so clear. I  
10 mean, think about codes. You say, good engineering  
11 practices. But how good the codes need to be depends upon  
12 the risk of getting the wrong answer from the codes. But I  
13 don't know -- the independent thing. You can't just say a  
14 code is good engineering practice.

15 MR. KING: No, no. Codes and standards here means  
16 things like the ASME boiler and pressure.

17 DR. WALLIS: Oh, it doesn't mean thermohydraulic  
18 codes?

19 MR. KING: No.

20 DR. APOSTOLAKIS: I missed that. Thermohydraulic  
21 codes are not good engineering practices?

22 [Laughter.]

23 CHAIRMAN POWERS: You can infer that from the  
24 comment. Yes.

25 DR. WALLIS: George, that is not what was said.

1 MR. BARTON: You can lead the horse to water, but  
2 you can't make him drink.

3 DR. APOSTOLAKIS: It was not intended to mean that,  
4 right? That's why I asked.

5 MS. DROUIN: Also, we have tactics, and the way  
6 we're going to implement them is where we start bringing in  
7 our risk insights. So if our risk is telling us that this  
8 is more important, then we would put more emphasis there.  
9 But if our risk is telling us it's not something we need to  
10 worry about, then we may not have to go into such detail.

11 So these are some examples of some things where we  
12 felt that the risk insights will help us in looking at our  
13 balance between prevention and mitigation.

14 So on the framework one, when you look at the four  
15 strategies and we're trying to balance across that, whether  
16 we're focusing more here or more here, this is a place where  
17 we would use our risk insights as an example on the  
18 framework. Our level of redundancy, diversity. When you  
19 start looking at your systems and components would be  
20 another place where we would use our risk insights to help  
21 us. Guidelines for passive component failures, where you're  
22 seeing the failure criterion, for example. And also for  
23 temporary conditions.

24 So here is just some examples of where the  
25 insights from our PRAs would come help guide us.

1           The next part of the framework and probably the  
2 most controversial -- I don't know if controversial or -- we  
3 didn't explain it well enough -- is what we call our  
4 quantitative guidelines. And in looking at this, maybe the  
5 second bullet should have appeared first because this seems  
6 to cause the most confusion; is that this is for staff use.  
7 This is to help us when we're framing the technical  
8 requirements, whether we're deciding a requirement needs to  
9 be screened; how to formulate it. When we come from a risk  
10 perspective, particularly when we talk about the tactics  
11 before, these -- we've put numerical guidelines to kind of  
12 help us to decide, you know, whether we're in the ballpark  
13 or not.

14           DR. KRESS: Can I ask you to rephrase a question  
15 asked earlier that I'm not sure I asked it right the first  
16 time. One of those guidelines is a core damage frequency,  
17 10 to the minus 4 per year as a mean value.

18           MS. DROUIN: Correct.

19           DR. KRESS: Now, and some sort of balance among the  
20 sequences that contribute to that. If I allowed people to -  
21 - or the designer or the licensee -- to independently fool  
22 around with the things that affect the sequences and you  
23 could come up with a combination -- various combinations of  
24 sequences that would end up with that same 10 to the minus  
25 4. You know, in some designs, you may end up with one

1 sequence producing most of it, and other designs you may end  
2 up with all of the sequences contributing relatively about  
3 the same amount. You know, this is what I have in mind.

4 Now, in this whole process, I see no mention of  
5 uncertainty in these guidelines. And what I'm asking is if  
6 one of these combinations ends up with a CDF of 10 to the  
7 minus 4, but a relatively narrow variance, small  
8 uncertainty, and another combination ends up with the same  
9 10 to the minus 4, but a bigger, much bigger, variance, the  
10 guidelines seem to tell me that either one of those are  
11 acceptable. And somehow, I don't think they're equivalent  
12 at all.

13 MS. DROUIN: They aren't.

14 DR. KRESS: And there seems -- it seems to me like  
15 the guidelines need some sort of recognition that these are  
16 not the same and that there are some need for a --  
17 guidelines on the acceptability of the uncertainty itself.  
18 Now, that's my question. Now, I didn't -- I don't see any  
19 such guidelines in there.

20 MR. KING: There's two parts to your question. One  
21 either case, if one sequence was chewing up the whole 10 to  
22 the minus fourth, that wouldn't be acceptable. We talked  
23 yesterday about, you know, we had a rule of thumb, you know  
24 no more than 10 percent.

25 DR. KRESS: Suppose that one sequence, because of

1 its very well established sequence. You know everything  
2 very well that goes into it. So having that particular  
3 sequence gives you a very small uncertainty in that CDF  
4 value. You know, 95 percentile is very near the mean. And  
5 it seems to me like that would be a -- not only acceptable,  
6 but preferable. You know, it's that sort of thinking I  
7 don't see present in there.

8 MR. KING: I'm sure having all your CDF tied up in  
9 one sequence is preferable, whether it's got a narrow  
10 uncertainty band or a wide uncertainty band. In the way the  
11 guidelines are set up, we say that's acceptable.

12 DR. KRESS: Yeah, but the reason you're doing that  
13 is because -- is to compensate for the uncertainty. And I'm  
14 saying if the uncertainty were -- didn't need compensating  
15 for because it was one sequence -- very steep curve, and  
16 that's probably ought to be better compensation than trying  
17 to limit the contribution.

18 MS. DROUIN: The way we're addressing it. We're  
19 going to get to a slide on that, but I'll - is to look at  
20 what is causing the spread. And that is something that we  
21 have in -- we may not have it well explained in the  
22 guideline, but it is our intention and we're going to get a  
23 slide on certainties and maybe some of that will come clear  
24 when we get there.

25 DR. KRESS: Yeah, well, I personally think you need

1 some sort of guidance, quantitative guidance, on what an  
2 acceptable uncertainty is, and let the licensees have the  
3 freedom to muck around with these sequences so long as he  
4 stays within an acceptable uncertainty.

5 MS. DROUIN: But I certainly believe that you have  
6 to look at the spread and what's causing it, and then  
7 depending on that, you're going to make your decision.

8 DR. KRESS: Well, yeah, once again, if it's  
9 acceptable. I don't know whether you have to look at it or  
10 not--the uncertainty--

11 MR. KING: Perhaps it depends on what is  
12 acceptable.

13 DR. APOSTOLAKIS: Perhaps you also need -- a way  
14 out of this is to put somewhere there that -- as -- for a  
15 particular issue, as you're approaching the actual numbers  
16 you're using, you're going to have this famous increased  
17 management attention. That's the least we can do right now.  
18 In other words, that includes looking at the uncertainty and  
19 the causes--

20 DR. KRESS: I don't take that concept would apply  
21 there.

22 MR. KING: But again, these are the steps -- the  
23 licensee isn't going to be doing this.

24 DR. KRESS: Yeah, I don't think that applies there.

25 DR. APOSTOLAKIS: Why? The staff will look at

1 this?

2 MR. KING: Yeah, this is for the staff.

3 DR. KRESS: Increased management attention means  
4 they're going to look at the regulations and do something  
5 else to the regulation.

6 MR. SHACK: But, given that certain -- the staff is  
7 looking at these things, and they realize that one is more  
8 uncertain than the other, presumably they will balance their  
9 regulations with that in mind. I mean--

10 DR. KRESS: I would hope so, but I don't know what  
11 their guidance is there. That's my problem. See, I would  
12 hope they would do that.

13 MR. KING: I think we need some general guidelines,  
14 and we're working on that. Mary has got a slide on it. I  
15 still disagree with your premise that you would allow one  
16 sequence to chew up the whole 10 to the minus fourth, even  
17 if the uncertainty band was very narrow.

18 DR. KRESS: I don't think you'll find a sequence  
19 like that. It was just a hypothetical case.

20 MR. KING: Well, to me that's a vulnerability that,  
21 you know, you ought to go look at--

22 DR. APOSTOLAKIS: I think earthquakes can very  
23 easily do that. In some plants, they just do it.

24 DR. KRESS: Yeah, but I -- but it's the opposite.  
25 I think the earthquake gives you a pretty wide--

1 DR. APOSTOLAKIS: But it dominates everything.

2 DR. KRESS: Variance. Yeah, but in that case, it's  
3 -- it doesn't give you a narrow band. It gives you a wide  
4 one. There, you have to really worry about it, I think.

5 MR. KING: But what we talked about yesterday --  
6 well, let's not be so rigid and say, well, it can only be 10  
7 percent of the CDF, and I agree with that. We need to be  
8 more a little bit more flexible.

9 DR. APOSTOLAKIS: But I still don't understand the  
10 difference between licensee and staff. It seems to me that  
11 the increased management attention idea applies to both.

12 MR. KING: But for the purposes--

13 DR. APOSTOLAKIS: In other words, if you are  
14 dealing with a regulation that flows from this framework  
15 that you realize brings you -- or it deals with an issue  
16 that is very close to 0.1 containment failure, condition of  
17 containment failure, for example, or a 10 to the minus 4 for  
18 damage, you know, according to one of your categories, it  
19 seems to me that there will be more attention to it, and the  
20 kinds of uncertainties are involved--

21 DR. KRESS: What do you mean in this case that you  
22 would take that specific plant and apply more inspections--

23  
24 DR. APOSTOLAKIS: I don't know.

25 DR. KRESS: Or make it do something different in



1 terms of--

2 DR. APOSTOLAKIS: It would be very case specific.  
3 But it will be handled I bet with much more care than  
4 something else that is buried down in the details, and it's  
5 away from the numbers that they're showing us. I think it  
6 makes sense.

7 CHAIRMAN POWERS: I'm still wrestling with what I  
8 thought was a truism that I accepted blindly yesterday, and  
9 maybe I'm less willing to accept blindly: that we won't let  
10 one sequence chew up large fractions of our available risk  
11 base. Because when I think about safety during shutdown  
12 operations, my attention comes to things like mid-loop  
13 operation. It's with a -- with the understanding that I  
14 have a primitive understanding of risk during shutdown  
15 operations borne of just a couple of scoping studies and  
16 taken by the staff. I think that chews up a large fraction  
17 of the available risk space during shutdown, and we live  
18 with it. We just watch that particular operation very, very  
19 carefully.

20 MR. KING: For a short period of time, that's true.

21 DR. KRESS: Yes, maybe 50 percent of the risk,  
22 though. Even for a sort period of time, it adds up to 50  
23 percent of the risk.

24 CHAIRMAN POWERS: Well, in some contexts, a year is  
25 a short period of time. And so -- I mean, see it's the

1 available question, we know what you are, we're just arguing  
2 about price now. If you're willing to let one accident type  
3 eat up all the risk and shutdown places, why don't we let  
4 one accident type eat up large fractions of risk space in  
5 another accident.

6 DR. KRESS: Yeah, and that's why I say as long as  
7 the overall uncertainty is acceptable, you shouldn't have  
8 it. We shouldn't restrict it. This is overly restrictive  
9 in my opinion. You could put any number on it. What you  
10 need is a criteria on what is an acceptable uncertainty, and  
11 that might very well depend on your CDF. If you're -- we've  
12 chosen the CDF of 10 to the minus 4. And there ought to be  
13 an acceptable uncertainty on that. And I would guess that's  
14 -- 95 percent confidence is not more than 10 to the minus 3.  
15 And as long as they stayed within that, you shouldn't -- you  
16 should let the sequences dictate that as they would.

17 DR. APOSTOLAKIS: I think the issue is slightly  
18 different. This one-tenth is basically a defense-in-depth  
19 measure, which is justified on the basis that there are  
20 significant uncertainties, model uncertainties, that are not  
21 really understood at the sequence level. So you would like  
22 to limit the known sequence frequencies to one-tenth of the  
23 goal so you will not be surprised at some point in the  
24 future. And I think, Tom, what you're trying to do is  
25 you're trying to use a rationalist argument.

1 DR. KRESS: I -- absolutely.

2 DR. APOSTOLAKIS: So you're starting with the  
3 premise that we do understand these uncertainties.

4 DR. KRESS: No, what sort of premises--

5 DR. APOSTOLAKIS: Yeah, because we're talking  
6 about--

7 DR. KRESS: A partial fraction of it.

8 DR. APOSTOLAKIS: Right.

9 DR. KRESS: And you can use those as guidance.

10 DR. APOSTOLAKIS: Yeah, that's a semi-rationalist,  
11 but it's a similar problem of the what if you're wrong  
12 business. So I think the fundamental question is do you  
13 really need to have defense-in-depth in the structure of the  
14 sense at the top two tiers? If you talk about prevention  
15 versus mitigation, then the four strategies. And then have  
16 another layer of defense-in-depth in the structural sense at  
17 this level of accident sequences. Where do you draw the  
18 line? Maybe -- you have -- you have holes in your accident  
19 sequence analysis, but the fact that you are already dealing  
20 with the four levels is good enough. If you screwed it up a  
21 little bit in the sequences here, but you have the condition  
22 containment failure probability to save you. See, these are  
23 the fundamental questions that we have to address.

24 Arguments, and I'm not saying that the answer is  
25 obvious, by the way. But I'm placing what you're presenting

1 here in a slightly different context. The fundamental  
2 approach of the structuralist is that gee, I really don't  
3 know. I'm uncomfortable. I will impose something to cover  
4 myself. And the question here is how many times are you  
5 going to do that? Now, what you're arguing, Tom, is that I  
6 guess we know already enough at this level, even though we  
7 are willing to allow for some--

8 DR. KRESS: That's why we're risk-informing the  
9 regulations.

10 DR. APOSTOLAKIS: Right.

11 DR. KRESS: Is because we now know enough.

12 DR. APOSTOLAKIS: So I don't know. But I would --  
13 I think this is the real issue, and I think, you know,  
14 having the top two or three tiers already being  
15 structuralist, maybe that's good enough. And for -- now,  
16 having a balanced design is a desirable property, but let's  
17 not make a big deal out of it, because we know that in  
18 shutdown or a seismic or fire sometimes you can't achieve  
19 it. I mean, these things don't--

20 DR. KRESS: But, George, if you're going to talk  
21 about this balance among the sequences, you either have to  
22 specify some percentage contribution to the mean, or you  
23 have to do something else. And I don't -- you know, we --  
24 they've chosen 10 percent. But, you know, they might chose  
25 another number, but you have to deal with it some way. And

1 if you're going to balance this -- the -- get a balance  
2 among the sequences, my suggestion was that give yourself a  
3 guidance on what uncertainty is acceptable to you, and let  
4 that dictate the balance. And that gives the flexibility  
5 and the freedom to do it one way, and it still gives you  
6 this measure of defense-in-depth, because you're doing it in  
7 a rationalist way rather than--

8 DR. APOSTOLAKIS: Well, that -- that probably would  
9 be much more relevant to new designs, and I'm not sure in  
10 what--

11 DR. KRESS: No, because I think what the result of  
12 this redoing of the regulations is going to be is there will  
13 be attempts to take advantage -- well, take the benefits  
14 that derive from it by changing the design. You will result  
15 in changing something at the plant.

16 DR. APOSTOLAKIS: I think if you go to the IPE  
17 reports that Mary and her colleagues have developed, the  
18 summary reports, I think you will very quickly convince  
19 yourself that this is a irrelevant point. I mean, do you  
20 see those pie charts, and you have 60 percent, 70 percent  
21 contribution from various initiatives. And I can't see a  
22 regulation really changing that dramatically and bringing  
23 down everything to 10 percent.

24 DR. KRESS: Well, I can't either. But what I'm  
25 saying is that the talking about a guidance of 10 to the

1 minus 4 CDF per year--

2 DR. APOSTOLAKIS: Yeah.

3 DR. KRESS: Is not a complete specification. It's  
4 very incomplete.

5 DR. APOSTOLAKIS: I understand that.

6 DR. KRESS: Yeah, and you can't live, in my mind,  
7 with an incomplete specification.

8 DR. APOSTOLAKIS: I think we're mixing two issues  
9 here.

10 DR. KRESS: Yeah, well, we may be.

11 DR. APOSTOLAKIS: And let me see--

12 DR. KRESS: But they're related. They're related.

13 DR. APOSTOLAKIS: If I -- if there -- can identify  
14 them and if you agree. The first issue is the use of this  
15 defense -- additional defense-in-depth measure in the  
16 structuralist sense at this lower level. Are we covered  
17 already by the higher tier so we don't have to worry about  
18 it here.

19 And more importantly, in the context of existing  
20 reactors. And for future reactors, we may want to revisit  
21 that. That's the first issue.

22 DR. KRESS: Yeah.

23 DR. APOSTOLAKIS: The second issue, which is really  
24 independent of this, is -- what you are saying, Tom, is  
25 that I think I know already enough -- maybe I've missed a

1 few things. But I know enough to be able to forget about  
2 the structuralist approach and do it on a rationalist basis  
3 admitting that I may have some holes in my analysis. But  
4 even if I knew everything, you are raising the question of  
5 whether using mean values is sufficient. And that doesn't  
6 apply only to this level. It applies to all levels.

7 So that's what I'm saying: there are two different  
8 issues that -- is it legitimate to work only with mean  
9 values no matter what the level is -- that's your primary  
10 concern.

11 And the other concern is should we really invoke  
12 structuralist arguments at this level in the context of the  
13 current generation of light water reactors? Okay.

14 DR. KRESS: Yeah, those -- that's a good phrase--

15 DR. APOSTOLAKIS: Now, Dr. Kress is giving an  
16 answer already to his concern that he would like to see a  
17 statement in addition to the mean value dealing with a  
18 percentile or something. And I would add to the first one -  
19 - that my personal view is that it's probably not necessary  
20 to have this additional defense-in-depth layer there, given  
21 that I already have two or three above--prevention  
22 mitigation, initiating events, conditional core damage.  
23 It's probably not necessary for the present generation.  
24 Maybe a statement that the more balance the design it is,  
25 the more desirable it is. That would be good enough buried

1 someplace without making a big deal out of it. That's my  
2 initial reaction to it.

3 In other words, I am willing -- I am willing -- I  
4 am going along with the recommendation by the staff that at  
5 the two tiers -- is it two or three, Mary? Show us again -  
6 - I mean, I seem to give random numbers here. So we have  
7 the prevention versus mitigation. That's one tier, right?  
8 And what you call strategies in another viewgraph is really  
9 below. There is a viewgraph where these two are below. So  
10 it's either one or two tiers anyway. It depends on how you  
11 look at it. If you go with a solid lines, it's four.

12 Anyway, I think we have built into the system  
13 sufficient defense-in-depth at that level so that we don't  
14 have to invoke it immediately at the one level below and  
15 make the one-tenth sort of -- that's my personal view.

16 And then I would try to be as rationalist as I can  
17 below these levels, in which case I'll worry about your  
18 concern as well. And only when I reach cases where I  
19 clearly know that I have either not modeled something, like  
20 smoke, right, the perennial example, or I have modeled  
21 something in an incomplete way, like human error, action of  
22 recovery and so on, then I would say, sorry, fellows, but  
23 I'll have to go back to my structuralist attitude and  
24 require some extra protection. That's the way I would see  
25 this.



1 So just an expression of preference.

2 MR. BONACA: I agree with you. I agree with you.

3 DR. APOSTOLAKIS: If you will -- but a balanced  
4 design probably would be good enough.

5 MR. KING: Yeah, well, I agree the 10 percent  
6 number is too rigid, as we discussed yesterday. But I'm  
7 also uncomfortable saying you can have one sequence chew up  
8 the entire CDF, and how do you achieve some -- deal with  
9 that issue in some flexible way is what we need to work on.

10 DR. APOSTOLAKIS: I think you can express this  
11 concern and maybe put some words there as to the fact that  
12 somebody is going to look into it without being rigid in  
13 your approach. I agree. But that is not a structuralist  
14 approach. I mean, you're actually addressing the question  
15 of a balanced design and maybe there is something we can do  
16 about it. Maybe, eventually, in some cases, you will have  
17 to invoke defense-in-depth. I don't know. But--

18 MR. KING: Yeah, I see -- to me it's structuralist  
19 to say I don't want to have one sequence take up my entire  
20 CDF.

21 DR. APOSTOLAKIS: That's right. But the reason--

22 MR. KING: Yeah, how do you deal with that is--

23 DR. APOSTOLAKIS: But the structure, you see -- I  
24 think 20 years ago, it would make more sense. With all the  
25 PRAs and the IPES that have been done both here and

1 internationally, we are fairly confident that the -- at  
2 least for power operations no one will come forth with one  
3 new sequence that every -- where everybody will say, my God,  
4 you know, how come we didn't think of that? And all of a  
5 sudden, you know, the whole balance is upset. Mary, what do  
6 you think? I think we have fairly good confidence that we  
7 have identified the important sequences. I mean, so many  
8 people have gotten involved--all over the world.

9 MS. DROUIN: I go back and I look at 11.50. I  
10 think there's a good example there. And if you go to the  
11 Grand Gulf analysis of 11.50, and you saw a mean core damage  
12 frequency of about 5 e minus 6. And you saw that 95 percent  
13 of the contribution was from station blackout. Now is that  
14 saying that that plant doesn't have a balanced design? I  
15 would argue it was the exact opposite. The reason you got  
16 the 95 percent from station blackout is because you had such  
17 redundancy and diversity that the only thing to take  
18 anything out--

19 DR. APOSTOLAKIS: Was a good common cause failure.

20 MS. DROUIN: Was a common cause failure.

21 DR. APOSTOLAKIS: And I think you are raising  
22 another important issue that I think Tom should take into  
23 account. A balanced design by itself, is not really a  
24 desire -- I mean -- it's desired, but it's not a big deal.  
25 I think the absolute value of where you are on this scale is

1 also very important. Mary just said for that plant it was  
2 already 5 10 to the minus 6 core damage frequency you said?

3 But that's already low -- a lot very low. So  
4 whether it's balanced or not, I really don't care anymore.

5 DR. KRESS: Then my recommendation that you give us  
6 specification on the acceptable uncertainty in terms of say  
7 a 95 percent confidence level that you only have 10 to the  
8 minus 3, say, would be accommodated within that framework.  
9 If the CDF is actually 10 to the minus 8, but it's  
10 completely dominated by one sequence, you still have 95  
11 percent confidence that that doesn't exceed 10 to the minus  
12 4 even. In other words, something like that. So that's a  
13 very acceptable design.

14 DR. APOSTOLAKIS: I think in some places there is  
15 going to be a seismic risk, which is typically seven, eight  
16 orders of magnitude.

17 DR. KRESS: Yeah, and when you give a specification  
18 like I talked about on the confidence level or the  
19 acceptable uncertainty, and it accommodates that problem and  
20 gives the flexibility to have a -- it's basically a sliding  
21 scale. The further you are down on CDF's, say, the more you  
22 can allow this unbalance. And that's why I suggested it.

23 DR. APOSTOLAKIS: I think I agree with Tom,  
24 though, when it came to low power and shutdown. I think  
25 their argument has more validity there simply because we

1 have not done the same kind of studies that we have done for  
2 the power correlations.

3 DR. KRESS: Then you may have a difference.

4 DR. APOSTOLAKIS: There, we may be surprised.  
5 Somebody, somewhere tomorrow may do some more complete  
6 analysis and come back with a sequence that we haven't  
7 really thought of.

8 MS. DROUIN: I think when we talk about a balanced  
9 design, it's not so much a balanced design as you don't  
10 want, you know, a single thing overriding your risk.

11 DR. APOSTOLAKIS: I'm not sure it's just a single  
12 thing, Mary. I think--

13 MS. DROUIN: Well, I--

14 DR. APOSTOLAKIS: I think it's really the degree of  
15 belief you have in the completeness of your analysis.  
16 That's where the structuralist acquires some respectability.  
17 In other words, I--

18 MS. DROUIN: I think you're going to have to take  
19 that into account.

20 DR. APOSTOLAKIS: The question what if you're  
21 wrong. It seems to me that it's a much more valid question  
22 for low power shutdown operations since we haven't done as  
23 complete a job as for power operations. So I don't know. I  
24 mean, the French came up with this idea -- idea, it's a fact  
25 -- that mid-loop operations were dominant. And that's not

1 too far into, you know, the distant past. Was it 10, 15  
2 years maximum?

3 MR. KING: It was more recent than that.

4 MS. DROUIN: About 10 or 15. No.

5 DR. APOSTOLAKIS: I don't think it was before then.  
6 And then, you know, there have been some limited studies,  
7 both here and abroad, but the kind of study that we have for  
8 power operations have not been done. So I think some  
9 structuralist element for low power and shutdowns is  
10 appropriate. And that's consistent with the general view  
11 that the more -- the less complete your PRA is, the higher  
12 the price you pay in terms of conservatism. I'm very  
13 comfortable with that.

14 DR. WALLIS: George. George, I'm puzzled here. We  
15 have 19 slides, and we seem to be getting--

16 DR. APOSTOLAKIS: This is a fundamental question,  
17 though. The others we can go over.

18 DR. WALLIS: We will get. I don't know if they  
19 will because there may be other members who have questions  
20 on the other slides.

21 DR. APOSTOLAKIS: Sure.

22 MR. BONACA: I want to say -- I tend to agree with  
23 you, but you cannot exclude that the need may come for these  
24 kind of decisions to be made at the lower level. And so I  
25 think we have to--

1 MR. SHACK: How about PTX? That seems to me a low  
2 level -- you know, you sort of have an adjustable amount.  
3 How much were you willing to allow?

4 DR. APOSTOLAKIS: Sure. So maybe here you can make  
5 a distinction between the modes. I yield the floor.

6 DR. WALLIS: Which slide are we on?

7 MS. DROUIN: I don't know. I don't know where you  
8 want to go.

9 MR. KING: Well, Mary has suggested we jump to the  
10 slide of uncertainty.

11 DR. WALLIS: Well, you were on page six. You're on  
12 page 6.

13 DR. KRESS: I know, but we got to uncertainties, so  
14 I jumped to that.

15 DR. WALLIS: Well, could I ask the question on page  
16 six?

17 MS. DROUIN: Absolutely. We'll go back to page  
18 six.

19 DR. WALLIS: Because I have a real difficulty at a  
20 fundamental level. Maybe I'm very stupid, but these  
21 guidelines and adequate protection. And you say that the  
22 guidelines are something you shouldn't force plants to go  
23 beyond. Now if there's a speed limit of 60 miles an hour,  
24 you're saying you should force people to drive at less than  
25 60 miles a hour? So what are they allowed to drive at? And

1 it seems to be a very strange definition.

2 MS. DROUIN: What we're trying to say here is that  
3 we're going -- as we go and risk-inform a regulation, and we  
4 come up with options or requirements, we don't want to  
5 impose a requirement that would, in essence, force the plant  
6 or set of plants to go beyond the safety goals.

7 DR. WALLIS: But then this seems absolutely topsy-  
8 turvy. I mean the whole idea of regulation is to impose  
9 requirements, so what's your criterion for imposing  
10 requirements?

11 MR. KING: It's the safety goals.

12 DR. WALLIS: Okay, so--

13 MR. KING: The safety goals that establish a level  
14 of risk that the Commission would like all plants to  
15 achieve. It's an expectation.

16 DR. WALLIS: All plants must achieve the safety  
17 goal?

18 MR. KING: Must--

19 MS. DROUIN: No.

20 MR. KING: It's an expectation. It's not a rule.  
21 But in risk informing and going through and looking at the  
22 regulations, we're using those Commission expectations as  
23 sort of the target we're shooting for. If we're going to  
24 change the regulations--

25 DR. WALLIS: Well, this I have a problem with. I

1 mean, is the regulation to meet these obligations or are  
2 they something up there diffused so far away that you never  
3 have to reach them, these goals?

4 It's really peculiar I find. And--

5 MR. KING: The idea would be the changes we propose  
6 to the regulations would be directed toward achieving those  
7 goals. Not any -- not risk--

8 DR. WALLIS: But you have no adequate protection.  
9 So this seems like saying, we have a speed limit of 60 miles  
10 an hour, which is -- as long as people don't go over that,  
11 we're not going to worry. But there's nothing saying how  
12 fast they can go. 120 miles an hour. Okay, is that  
13 adequate protection. I just don't have any understanding of  
14 the basis of these statements.

15 MR. KING: The level of safety that's defined by  
16 the safety goals is a level of safety greater than what the  
17 concept of adequate protection would have in mind. And  
18 nobody's actually defined the level of safety for adequate  
19 protection.

20 DR. WALLIS: But that seems to me is deceiving the  
21 public. What are you trying to achieve? And if you're  
22 saying--

23 MR. KING: Trying to achieve the level--

24 DR. WALLIS: You're not going beyond something --  
25 that's as far -- if we go beyond that, we've done too much.



1 But how much is enough.

2 MR. KING: The level of safety defined by the  
3 safety goals is how much is enough.

4 DR. WALLIS: No, no, no. It's not. It's -- that's  
5 misuse of words.

6 MR. KING: Yeah, I disagree.

7 DR. KRESS: Graham, if I concocted a set of  
8 regulations that were made cleverly enough that it -- when  
9 the set of plants out there, licensees, conform to these  
10 regulations, but on the average, they meet the safety goals,  
11 and I'm not sure what an average means in this case. But  
12 let's say it has some good definition. Let's say that  
13 average CDF -- half the plants meet it and half the plants  
14 don't. Let's say that defines an average CDF that we're  
15 dealing with. Then I maintain that this set of regulations  
16 is restrictive enough that there is also an upper bound that  
17 they will not go beyond in terms of CDF. It may be like 10  
18 to the minus 3. It may be something else. I don't know  
19 what it is. But if you concoct the regulations to make  
20 people on the average get to, say, a 10 to the minus 4,  
21 there is an upper speed limit that they can't go beyond,  
22 because then it will violate these regulations somehow. So  
23 there is a speed limit there. It's implied. It's not  
24 required. It's not specified. It's not quantified. But  
25 it's there implicitly in the system.

1 DR. WALLIS: Oh, you can't have something mythical  
2 like that.

3 DR. KRESS: Well, it's not mythical. It's real.

4 DR. WALLIS: It's not quantified. It's not  
5 described, but it's there. It doesn't exist.

6 DR. KRESS: It's real, and I also believe that if -  
7 - that if such a -- if -- if such a plant had a  
8 vulnerability, they would put it very high on the chart of  
9 CDF or LERF, that it would get attention. I don't think it  
10 would be allowed.

11 DR. WALLIS: Well, I think this has to be  
12 explained. Listen, I don't want to keep on this. It's  
13 very, very strange regulation. So the average person that's  
14 on there will think, therefore--

15 MR. BONACA: Let me say one thing. It seems to me,  
16 and I did not participate in the e-mail debate, so I'll take  
17 this opportunity I guess to chip in, but it seems to me  
18 that, you know, so much of the regulation that defines by  
19 compliance with it, adequate protection -- okay, and before  
20 the safety goals were established. And yet, there was a  
21 belief that to the best of our knowledge, if you meet the  
22 regulation, you're safe. You have adequate protection.  
23 When the safety goals came of age after PRA came of age to  
24 some degree or the same time, then certain goals were  
25 established. However, there was never an equating

1 compliance with the goals and adequate protection. There  
2 was still a presumption that if you meet the regulation,  
3 whatever the regulation is, you have adequate protection.  
4 And if you have gaps in the regulation identified by PRA,  
5 then there was a direct recommendation I believe from the  
6 Commission that PRA could be used to identify gaps in the  
7 regulation and fill those gaps, striving still for meeting  
8 those goals. Now, I believe that core regulations, in some  
9 cases, probably in some -- in the specific apportionment in  
10 some cases you exceed the goals. In some cases, you don't  
11 exceed -- you don't meet them completely. But I think that  
12 we need consistency there.

13 CHAIRMAN POWERS: I'm going to have to intercede.  
14 I think we have scheduled the best part of four hours for  
15 Committee discussion on this part, point, I'd like -- I  
16 think we need to get the input from General Drouin and her  
17 troops here as much as we can and then move on and get input  
18 from Performance Technology and NEI, who -- General, can you  
19 give us a synoptic account of the remaining viewgraphs in  
20 five minutes?

21 MR. KING: Let's jump to slide 10.

22 MS. DROUIN: That's what I was going to propose.

23 DR. WALLIS: Well, on uncertainties. You had a  
24 slide on uncertainties.

25 MS. DROUIN: Yes.

1 DR. WALLIS: It seems to me that -- modeling  
2 uncertainties are accounting for which safety margins, and  
3 that forces you to say what margin is and to define it on  
4 the same scale as uncertainty rather than saying it's  
5 something indefinite, which somehow covers up uncertainty.  
6 I mean, it has to be then quantified on a scale -- the same  
7 scale as uncertainty -- so that a comparison can be made.

8 And the same thing goes with the bottom one.  
9 You're going to use safety margin defense-in-depth to  
10 account for something, incompleteness uncertainty, you have  
11 to have them defined and measured on some common scale so  
12 comparisons can be made. And it's not just a word game.

13 MR. KING: Yeah, I agree.

14 DR. WALLIS: Thank you.

15 MS. DROUIN: I don't know if you want to jump to  
16 50.44 immediately. This can maybe serve as an introduction,  
17 because they certainly apply to 50.44, and the issues that  
18 we will be bringing up in our Commission paper that goes  
19 forward on 50.44. But through that -- we have here, you  
20 know, is whether you should allow selective implementation  
21 within a regulation of the technical requirements, or  
22 whether you just package the whole thing and they either go  
23 with the current 50.44 or they have to take the risk-  
24 informed 50.44. But within it, they -- whether or not they  
25 can pick and chose.

1           We recognize this is a voluntary effort, but when  
2 you start looking at these and you start bringing in risk  
3 insights, there are going to be places where we've  
4 identified safety enhancement. And this should these be  
5 required to pass the back-fit rule. And at the same token,  
6 if we're going to be reducing things, should there be a kind  
7 of a reverse back-fit test.

8           So, in summary, those are the three issues--

9           MR. KING: Yeah, actually, there's one more we  
10 probably should have put on here, and that's the whole issue  
11 of using the safety goals--

12          MS. DROUIN: Yes.

13          MR. KING: As the level of safety in our framework  
14 that we're shooting in risk-informing the regulations and  
15 the risk allocation between CDF and LERF and so forth --  
16 make sure that they buy into that -- the way we have it laid  
17 out.

18          DR. UHRIG: What's the purpose of a reverse back  
19 fit?

20          MR. KING: Well, the idea would be -- this was  
21 actually suggested by one of our stakeholders. If we're  
22 going to make a burden reduction that's going to cause some  
23 small increase in risk, is it really worth doing? Is the  
24 burden reduction really big enough that we should even allow  
25 that to happen. You know, otherwise why bother if you're

1 not getting something really substantial out of it. And  
2 there should there be some rule of thumb that you'd use to  
3 make that test?

4 CHAIRMAN POWERS: One of our members has  
5 characterized it if it's sticky going up, it should be  
6 sticky going down as well.

7 DR. APOSTOLAKIS: But I don't understand that.

8 DR. KRESS: It should be stickier.

9 DR. APOSTOLAKIS: Because it takes resources from  
10 you?

11 MR. KING: Why what?

12 DR. APOSTOLAKIS: I don't understand why. I mean,  
13 if it's a small benefit why not bother?

14 CHAIRMAN POWERS: I guess that's the mystery that's  
15 going to remain -- please, we've really got to wrap up this  
16 discussion.

17 MS. DROUIN: We can go through I think 50.44.

18 CHAIRMAN POWERS: And I will confess to having an  
19 organizational conflict of interest in 50.44.

20 MS. DROUIN: Okay--

21 CHAIRMAN POWERS: Some strong opinions.

22 MS. DROUIN: When you look at 50.44 at a high  
23 level, it breaks down into what we call these analytical  
24 requirements and these physical requirements. And these are  
25 actually prescribed in the rule. When you look at the

1 analytical, it's talking about a postulated LOCA. It's only  
2 dealing with degraded cores, so its stocks in vessel. And  
3 the source term that is specified only deals with fuel  
4 cladding oxidation and then depending on the containment  
5 type, it's whether or not it's a 5 percent or a 75 percent  
6 metal-water reaction. And then based on those analytical  
7 requirements, 50.44 has imposed physical requirements to  
8 deal with those. You're required to measure hydrogen  
9 concentration and containment, ensure mixed containment  
10 atmosphere, control combustible gas concentrations, Mark I's  
11 and Mark II's to be inerted, having high point vents in your  
12 RCS system, and installing a hydrogen control system for  
13 your Mark III's and your ice condensers.

14 Okay, as we jump over to 18, what we're missing,  
15 and I'll just kind of jump to 18. Let me jump to 16, then  
16 18. Looking at 50.44 wasn't that simple. There are a lot  
17 of related regulations and implementing documents that were  
18 causing some of the problems. You saw that one analytical  
19 requirement was to measure hydrogen concentration, but one  
20 of the predominant means of compliance is that they have  
21 safety grate continuous monitors. Those other things came  
22 out of related regulations. So in dealing with 50.44 you  
23 have to deal with the whole package, and that's the only  
24 point I want to get across there.

25 Went through and, you know, brought in our risk

1 analysis looking at how your hydrogen, what your combustible  
2 gases were, how were they challenging containment, what were  
3 the accident types, et cetera. And in looking at all of  
4 that, the conclusion we came to is that a risk-informed  
5 50.44 should look like this. I mean, it needs to address  
6 all your core melt accidents. You're getting hydrogen from  
7 all of them. You're also getting combustible gases not just  
8 from your fuel cladding oxidation. You have to deal with  
9 your core concrete interaction, and we would like to have  
10 realistic calculations on the rate and amount of your  
11 combustible gases. And you need to, in controlling these,  
12 both look at the early and late phases depending on the  
13 containment type.

14 So now if we jump over to 18. In looking at a  
15 risk-informed 50.44, what composition can it take? And what  
16 we came up with is there's two ways to deal with this risk-  
17 informed 50.44. You can go to these six physical  
18 requirements and modify each one of them. That's one way to  
19 bring in your risk information. For example, eliminate the  
20 requirement for the safety-grade continuous monitors. One  
21 of the things that came out is that we didn't see that as a  
22 risk -- significant thing to have in there. But add the  
23 capability to measure long-term hydrogen concentration and  
24 that whatever instrumentation or whatever you're doing it  
25 can deal with it under degraded core conditions. Ensure



1 mixed containment atmosphere, but with significant accidents  
2 this is getting into where we're seeing station blackout  
3 playing a dominant role. And you aren't being able to deal  
4 with it under those conditions.

5 Eliminate the post-LOCA hydrogen control. That  
6 would be eliminated in the recombiners, et cetera.

7 The second alternative is much higher level, and  
8 would be much more flexible in that we would just say for  
9 the rule -- would be replaced with what we would call  
10 performance-based requirement, and it would just state for  
11 you to control your combustible gases for all light water  
12 reactors for the risk significant accidents.

13 DR. KRESS: Well, what would you mean by control  
14 there, Mary?

15 MS. DROUIN: Controlled so as you're not presenting  
16 a challenge to your containment integrity.

17 DR. KRESS: Okay, at a certain containment core  
18 damage frequency conditional or--

19 MS. DROUIN: Well, it would depend. You could come  
20 meet this many different ways. You could come in and show  
21 that you aren't having accidents of any kind of frequency.  
22 Or, give your accidents, you're not challenging your  
23 containment. Or you could come in and do it this way. You  
24 know, impose these physical things, and show that you have  
25 not challenged your containment because I'm inerted them--

1 DR. KRESS: Very controlled means it doesn't lead  
2 to a large conditional containment failure at a certain  
3 frequency level?

4 MR. KING: Right. But for risk-significant events.  
5 You've have to write a REG Guide to implement alternative  
6 two to put the frequency, the conditional containment  
7 failure probability guidelines in there.

8 MS. DROUIN: But it's the same thing. I mean, when  
9 you look at the one right now, you are trying to achieve  
10 this.

11 DR. KRESS: Yeah.

12 MS. DROUIN: But we're just not -- we would not be  
13 prescriptive. We -- you know, you could allow the licensee  
14 which method that he would want. Regardless, your risk-  
15 informed is going to require you to make changes to other  
16 regulations, particularly if a licensee chooses to go down  
17 that route, because some of those requirements are coming in  
18 from REG guides and coming in from other regulations.

19 DR. KRESS: I'll turn to two. It's general enough  
20 to deal with core concrete and interaction sources, I would  
21 presume?

22 MS. DROUIN: Yes.

23 DR. KRESS: But you would have to sort of a  
24 separate specification for that--

25 MR. KING: Right. One thing under alternative 2 is

1 we may specify the source term.

2 DR. KRESS: Yes.

3 MR. KING: The rate and amount coming in, and you  
4 need to include the core concrete interaction. Or you may  
5 let the licensee do it, but specify that, you know, it's for  
6 the full sequence, not just stopping in vessel. There's a  
7 lot of details to be worked out.

8 DR. KRESS: Yeah, but for the core concrete  
9 interaction since it's so much later on in the accident  
10 sequences, would you have a different criteria for what it  
11 needs to -- the frequency it would affect the containment  
12 and then the other would you have separate criteria for--

13 MS. DROUIN: Possibly. I can't give you a  
14 definitive answer.

15 DR. KRESS: Yeah, but you might have, because it -  
16 - you've had plenty of time to do the emergency response,  
17 for example.

18 MS. DROUIN: And that would be one thing you would  
19 take into account.

20 MR. KING: Yeah, there may be an early and a late  
21 type criteria.

22 MS. DROUIN: And then just our final one on  
23 schedule. We are moving forward to provide our  
24 recommendation to the Commission in August, and that would  
25 also include the policy issues, and, then given Commission

1 approval, proceed with rulemaking, hand it over to NRR and  
2 start performing also the plan regulatory analysis.

3 DR. APOSTOLAKIS: Is 50.44 part of Option 2 or 3?

4 MR. KING: Three.

5 DR. KRESS: Three. Option 2 is mostly scope.

6 DR. WALLIS: Mary, I'm almost as perplexed as--

7 CHAIRMAN POWERS: I'm going to cut off the debate  
8 here. I'm complying with our other speakers--

9 DR. WALLIS: Well, I want to ask -- I don't see  
10 what the second part of your presentation has to do with the  
11 first one. And the first one is some framework. And now  
12 you looked at how to improve 50.44. The example is used to  
13 illustrate and test the principles, then something, Jim,  
14 more general. I don't see how the two are related.

15 CHAIRMAN POWERS: 50.44.

16 DR. WALLIS: How you learn from this -- how we  
17 should be doing a more general thing, which is the first  
18 part of your presentation?

19 MR. KING: We had a couple hours. We could have  
20 talked about it.

21 DR. WALLIS: But I think we don't have enough time  
22 to apply the connection.

23 MR. KING: We could have applied the framework to  
24 5.44 and came up with the 50.44 recommendations and what we  
25 learned from that. But they are related.

1 MS. DROUIN: I mean, we have just given you the  
2 results, but we did use the framework in going through and  
3 coming up with those recommendations of what a risk-informed  
4 50.44 should look like. I just didn't walk you through on  
5 how we did it for lack of time.

6 MR. KING: There will be a report on 50.44 attached  
7 to the August paper, which will cover that point.

8 CHAIRMAN POWERS: Any other questions for these  
9 speakers. Then I'd like to move to the presentation by  
10 Andrian Heymer of the Nuclear Energy Institute.

11 MR. HEYMER: Good morning. My name is Adrian  
12 Heymer. I'm a Project Manager at NEI and I work on risk-  
13 informed issues. I report to Steve Floyd, who is our  
14 Director of Regulatory Reform.

15 Steve sends his apologies, but he's in Atlanta  
16 today talking to our executive committee. So I'm going to  
17 have to stand in for him.

18 I'm going to cover predominantly just option two  
19 and option three. I'll also make some brief comments on  
20 what I heard from the previous two presentations, just as a  
21 point of clarification perhaps of an industry position.

22 So I'll start with option two. I guess you heard  
23 that we've developed a guideline and we've provided some  
24 information to the NRC staff already and we've received some  
25 preliminary feedback. Our intent is to incorporate that

1 preliminary feedback as we move through the process and  
2 we're going to try and get an updated version to the staff  
3 in the August timeframe.

4 We heard what they said on treatment, we've heard  
5 what they've said on categorization, and we're going to try  
6 and put something together to address those issues.

7 We understood we were going to get formal comments  
8 in the middle of August and we see this as a work in  
9 process, by which they give us comments, we update the  
10 guideline, so that we can move this process forward as soon  
11 as possible.

12 There was a fair bit of discussion on PRA quality  
13 and completeness, and you heard that we have submitted the  
14 certification documents. We've also had some discussion in  
15 the industry recently, especially at our working group  
16 meeting yesterday, about how do we make PRA information, the  
17 latest information available to the NRC, how do we put it in  
18 a format that is controlled, and how do we keep really the  
19 public informed of where we are.

20 We note that there are issues being decided that  
21 are based upon the IPEs, which are approaching ten years  
22 old, in many instances, and we think it's important. We've  
23 moved beyond that and we think it's important to provide  
24 information that's current.

25 And how do we do that in the public arena and how

1 do we get the industry to move forward in that regard?

2 On the detailed regulatory appendix, we don't  
3 think that's a practical approach. We think it's important,  
4 as we stated in the previous presentation, that you should  
5 just have the high level requirements in the regulations.  
6 If you want to call it an appendix, that's fine, but the  
7 implementation details in the guideline which is then  
8 endorsed by the NRC.

9 If you go down that approach, we're not quite sure  
10 why you would need prior NRC review and approval of specific  
11 licensees once we've moved beyond the initial activities  
12 that lead up to the final rule.

13 You've got a rule, you've got a detailed guideline  
14 that has been endorsed by the agency. That should be  
15 sufficient. That doesn't mean to say that a licensee can  
16 just go off and start work. We recommended in our comments  
17 that there be a notification and in that notification, you  
18 deal with such things as what regulations are being adopted,  
19 how you address the PRA quality, perhaps provide a summary  
20 of your certification results, if it's certification.

21 On selective and voluntary, I think there is a  
22 general understanding that this process is voluntary. There  
23 is the debate on selective, does it apply to regulations and  
24 systems. And I think on regulations, we're saying, yes, it  
25 should be selective as regards option two. What is

1 beneficial for one person may not be beneficial for another  
2 plant.

3 As regards the systems, I think we need to  
4 recognize that we have done categorization of structures,  
5 systems and components, the risk-informed process, before.

6 There are some insights. Admittedly, it varied  
7 across the industry. And there may be sufficient  
8 information available that allows someone to move forward  
9 and say this set of systems or this set of components are  
10 safety-significant today, without any further analysis.

11 It's also this is a time-consuming exercise and it  
12 does take some time. So I think it's going to be a phased  
13 evolution. You do a set of systems, you apply special  
14 treatment, and then you move forward.

15 So I think it's important to understand that from  
16 a systems perspective.

17 We looked at the document that was provided to the  
18 staff, which was developed by South Texas Project, on a  
19 comparison between the NEI guideline and the South Texas  
20 Project. I think, in general, we believe we are reasonably  
21 consistent. There are some clarifications needed to that  
22 document and we've provided that and we've asked -- we're  
23 developing an updated version.

24 I think you've got to expect that at a high level,  
25 when you get down into the implementation phase with a



1 specific licensee, there may be some differences between the  
2 licensee's approach, differences between the licensees on  
3 their various approaches, but they could still be consistent  
4 with the guideline. So generally consistent, they match the  
5 guideline, but you may see some differences, slight  
6 differences in approaches between licensees based on their  
7 practices and varying designs.

8 I think the staff, quite rightly, pointed out that  
9 commercial programs is a central issue and we are pleased to  
10 see that the NRC staff is going out looking at those  
11 programs. We also recognize that -- I think this has been  
12 described as there's nuclear commercial programs and there's  
13 commercial programs, a Yugo versus a Rolls Royce.

14 I think that's good to see. I think it's also  
15 good to see that the staff are going out and getting, if you  
16 like, more information about those activities, because I  
17 think it is central to where we stand.

18 I guess the point on the guideline is that it  
19 doesn't necessarily have to be absolutely perfect and prim  
20 to start the pilot project. It should give us confidence in  
21 the main areas to move forward, but it doesn't have to be  
22 absolutely perfect. I think the pilot project should enable  
23 us to add clarifications and provide more specifics,  
24 especially in terms of examples that would help industry in  
25 a later version.

1 I mentioned before that we had taken some comments  
2 from the staff earlier and we are adjusting our position as  
3 we go. We got a concurrence yesterday from our working  
4 group to really try and streamline the process to --  
5 initially, we had box two as two sub-categories. We have  
6 decided to streamline and put that into box one.

7 What we're saying there is that there would be no  
8 change in treatment requirements for matters that are in box  
9 two.

10 I think the discussions and debate that center  
11 around the commercial programs need to recognize that we've  
12 also -- we've already moved forward into a risk-informed  
13 world with some of the other activities, ISI, IST, and the  
14 maintenance rule.

15 And we've put in place performance criteria and  
16 controls. In some cases, licensees looked at what they  
17 found from the maintenance rule or from the ISI and IST  
18 programs and added some additional controls because of what  
19 they found in the categorization process.

20 So the number of non-safety-related SSCs that are  
21 up in this RISC-2 category are subject to, if you like,  
22 improved controls, better controls, commercial controls, and  
23 are subject to a performance monitoring program that  
24 provides reasonable assurance that the safety functions will  
25 be satisfied.

1           And it's those same programs that we intend to  
2   employ down here in box three. So we think if it's been  
3   good enough the last four years up here in box two, then it  
4   should be satisfactory for matters that are of low safety  
5   significance, and when coupled with a monitoring program, if  
6   that's appropriate, to provide some assurance that the  
7   required function, the function required by the regulation  
8   still makes it have that regulatory link or that licensing  
9   link is satisfied.

10           DR. BONACA: What you're saying is that RISC-3  
11   also will have subject to monitoring program and augmented  
12   quality.

13           MR. HEYMER: Not augmented quality. Commercial.

14           DR. BONACA: So they're not equal. RISC-3, you're  
15   taking those component and putting them at the commercial  
16   level. You're not doing the vice versa. You're just simply  
17   saying you just monitor.

18           MR. HEYMER: Based on the experiences that we've  
19   had over the last few years with assuring that these -- that  
20   they satisfy the monitoring program and with the controls,  
21   that provides reasonable assurance that the risk significant  
22   or the safety significant function would be satisfied.

23           I think it's also worthwhile to point out that we  
24   recognize that not all plants develop their performance  
25   thresholds and their performance criteria based on all

1 failures. Some just took MPFF, maintenance preventable  
2 functional failures, and folded those in.

3 So I think where that's the case, our guideline  
4 says that you need to go back and revisit the performance  
5 criteria and need to take a look at the controls to provide  
6 itself that assurance.

7 Other option two issues. Some people feel there  
8 might be some legal issues out there. We don't think so,  
9 but we don't want to get down the path in November and find  
10 out that there are some legal issues.

11 So we would just like a read from the staff that,  
12 yes, we can move forward and as we have proposed in our  
13 guideline, there is nothing to prevent us, from a legal  
14 perspective, in implementing this option two process.

15 We've discussed a little bit about the commercial  
16 treatment for box three.

17 On the treatment of prior commitments for box  
18 three, I think that the suggestion was made that we -- we've  
19 proposed or someone has proposed, and it was us, NEI, that  
20 we eliminate all the commitments.

21 I think it's because these are of low safety  
22 significance or we think that you should replace the  
23 previous commitments with a commitment to monitor these SSCs  
24 against criteria sufficient to provide reasonable assurance  
25 that the functions that are required by the regulation will

1 be satisfied.

2 Now, in some cases, it's recognized that  
3 monitoring is not appropriate and in that case, you would  
4 have to have some commercial controls in place to provide  
5 that assurance, but it's not the same assurance as for box  
6 one.

7 So that's where we come about. It's right that  
8 initially we felt that rulemaking might be able to address  
9 this and we agreed with the staff, it doesn't really hit the  
10 nail correctly, and the industry guideline on managing NRC  
11 commitments requires you to do a line-by-line, commitment-  
12 by-commitment evaluation.

13 Our position is if these items are of low safety  
14 significance, then there should be no need to do that,  
15 providing that we replace it with a commitment that says we  
16 monitor at a level that provides assurance that the  
17 regulatory function will be satisfied.

18 I think as regards design basis, and there was a  
19 mention about that earlier. I think where we come from is  
20 that the pedigree is not linked to the design basis. The  
21 technical parameters would still remain the same, if it's  
22 required to operate in an ambient environment at 460  
23 Fahrenheit, then that would still be a requirement in there.  
24 We're not going to change that.

25 Now, with regard to the amount of testing and

1 paperwork that you have in hand for a box three SSC to  
2 support that, that might be different for a box three as  
3 opposed to a box one, when you compare what's required by  
4 50.49 as opposed to a commercial program.

5 On the pilot plants, I just want to clarify, we  
6 are using the owners' groups to look at this. The owners'  
7 groups are going to use a concept by which they have a lead  
8 plant and then if that lead plant comes through the process  
9 all right, looking at one system that goes up and one system  
10 that goes down, and they're going to assess that. Then if  
11 that's okay, then they're going to broaden it to a larger  
12 number of plants to do a similar sort of process, picking  
13 two systems, one that goes into box two and one that goes  
14 into box three predominantly.

15 The boiling water reactor owner's group is  
16 probably further along than some of the others and they're  
17 having a meeting in the early part of August to really start  
18 this process moving, with probably the lead plant to start  
19 in the fall. The others were just a little bit behind, but  
20 not much more.

21 So that's how we address the variability of  
22 designs is by looking at the owners' groups and being a  
23 voluntary activity, not all plants are going to follow  
24 through.

25 That's all I've got on option two.

1 On option three --

2 DR. BONACA: Just before you leave option two, I  
3 would just like to make a comment regarding RISC-2. I still  
4 believe that there is an inconsistency in the way you are  
5 treating it. If you find that -- the South Texas Project I  
6 believe identified on the order of 300 components under  
7 RISC-2 and thousands of components under RISC-3.

8 And it seems to me that you are now allowing to go  
9 to commercial grade for RISC-3 components, and I agree with  
10 that, because we have identified it as not safety  
11 significant.

12 For the hundreds that you identify that are safety  
13 significant, I think that still there is a pretty loose  
14 commitment here. There isn't really an upgrade of the  
15 requirements.

16 You're saying, well, just because they were fine  
17 until now, that they're going to work fine in the future,  
18 and I think there is an inconsistency that I would like to  
19 raise.

20 MR. HEYMER: I would agree with you. If we hadn't  
21 gone through the process of the maintenance rule and some  
22 other risk-informed activities, whereby we've -- in the  
23 majority, those SSCs that move up into box two will have  
24 been identified under the maintenance rule.

25 Performance criteria for the majority of licensees

1 would have been imposed and, in some cases, controls  
2 adjusted to provide reasonable assurance that the risk  
3 significant functions or safety significant functions will  
4 be satisfied.

5 If we hadn't been there, I think I would agree  
6 with you. All we're saying is there may be some cases where  
7 you may have to do that. But by and large, we think that  
8 based on the previous work that's been done, we're already  
9 there on those SSCs. There is sufficient assurance that the  
10 safety function is going to be satisfied and, therefore,  
11 based on what we've got in place today, that should be  
12 satisfactory.

13 Now, if you don't satisfy the performance  
14 criteria, then you've got a different story. You've got to  
15 take corrective action and, if necessary, adjust the  
16 controls appropriately. That's why we're saying that.

17 I don't know if that addressed it.

18 CHAIRMAN POWERS: I think we need to move right  
19 along, and I think you've got some important things to say  
20 about option three.

21 MR. HEYMER: Yes. I think the staff has worked  
22 hard to develop something and put it together. They've  
23 tried to put some thought behind it, but it's to quantify,  
24 as we see it, all elements of the regulatory structure and  
25 it's what we see as a total quantification that gives us a



1 degree of concern.

2 We've expressed that concern in the past. It  
3 appears to us that with the way we read the framework  
4 document initially, it applied to licensees and that  
5 licensees would have to meet that, especially when you  
6 looked at the quantitative guidelines.

7 We now hear that that is not the intent. It's the  
8 intent that it's a regulatory benchmark, and that's fine,  
9 but you're going to be setting regulations against that  
10 benchmark and if I adopt the regulations, does that mean I  
11 have to satisfy the subsidiary objectives.

12 We are not quite sure that you can do a full  
13 quantification, the way it's written here, especially if you  
14 start going into large late release and internal and  
15 external events and all modes.

16 I'm not quite sure what information is out there,  
17 from an industry-wide perspective, that you would work from.  
18 There are some people that have gone that far, but not  
19 everyone.

20 So I guess we're struggling with the framework  
21 document. Based on a meeting we had on June 30th, we  
22 understand it's of an interim status and that it is being  
23 revised. It does focus a lot on a quantitative, almost  
24 total quantification, and we think that it's risk-informed  
25 is using PRAs as insights, along with operating experience

1 that we've gained over recent -- more than recent years,  
2 since we started operating these plants.

3 So it's a balanced approach, and we didn't  
4 necessarily see that in the framework document.

5 It appears to result in activities that ignore  
6 such things as EP, severe accident management guidelines,  
7 and I know that's probably not the intent, but that's the  
8 way we see it and that's certainly the way we heard it  
9 coming out as regards 50.44.

10 So I think we have some problems with the  
11 framework. We understand it's being rewritten. We don't  
12 think you can have a complete quantification and if you do  
13 and we set regulations against that, does that mean that if  
14 I satisfy the regulations, then I'm satisfying all these  
15 criteria, which seems to me to be imposing that back on the  
16 plant, from a requirement perspective.

17 So I think we may need to do some more work on  
18 that. I think that the format and their attempt to tie it  
19 to the cornerstones was good and I think that was a good  
20 start, but we just see a difference of approach between  
21 research and perhaps option two, where option two is more of  
22 a risk-informed, more of a practical slant, whereas here in  
23 option three, we see more of a full quantification, more of  
24 a risk-based approach.

25 DR. SHACK: Leaving aside the framework document

1 for the moment, how do you see the product, their first  
2 attempt to use the framework on 50.44? Does the product  
3 seem pragmatic?

4 MR. HEYMER: I think overall, I mean, there's a  
5 few issues out there that we're struggling to understand and  
6 we're struggling to understand them because we haven't seen  
7 -- until recently, they haven't released a basis for that  
8 detail, and I'm referring to some of the issues surrounding  
9 the igniters.

10 But once we see that, then we can comment on  
11 those. But they are moving forward. It may not be  
12 everything that the industry thought we might be able to  
13 achieve, but I think we're slowly getting there.

14 They noted in --

15 CHAIRMAN POWERS: Don't feel alone. We haven't  
16 seen these details either.

17 MR. HEYMER: The SECY-00-86, there appears to be  
18 an undercurrent of raising issues of past issues that have  
19 been resolved, and that's fine if there's some technical  
20 basis behind that. But if it's not, we have some concern  
21 about why they're being raised.

22 And we didn't jump up and down about the two  
23 issues that were brought up -- I think it was BWR line and  
24 melt-through in the reactor coolant pump seal, because we  
25 thought there might be some more information out there.

1 Whether there is or not, I don't know, but it's just that  
2 undertone.

3 If you consider where we were a year ago and the  
4 place that these activities have gone in the past, I think  
5 it's a commendable effort. We don't necessarily understand  
6 some of the things that they've come out with, because we  
7 haven't seen the basis.

8 The other thing is that some of the policy issues  
9 that have been raised, I think they're interesting, but I  
10 think they should be detached from the 50.54 activity. And  
11 I think with the exemption requests and the work that was  
12 done in moving forward on that exemption request for one  
13 plant and the work they have done to date and the workshops  
14 they have done and the fact that they're going to make the  
15 SECY available to the Commission, if that becomes public, we  
16 can provide input onto that and we should be able to move  
17 forward with a rulemaking this year, or at least a notice of  
18 proposed rulemaking this year.

19 I think I've really touched, in the essence of  
20 time, on these points already. I think it's important that  
21 we also understand that there is a cost-benefit element in  
22 this. There has to be some incentive for moving forward.

23 If there is a safety issue that is raised and  
24 identified, we're going to deal with that. If there's a  
25 sound basis for it, we'll deal with it, and if it requires

1 an add-on to the regulation, then that's what it is. But  
2 there must also be some form of balance of cost-benefit.

3 I heard the term reverse backfit this morning.  
4 I'm not quite sure what that means and I'm struggling with  
5 that. And I think before you can raise a policy issue up,  
6 you need to have a good understanding of what that means and  
7 provide input, if you want to go down that path.

8 I think to raise it at this point in time is  
9 somewhat premature, when it hasn't had -- when I don't know  
10 what it means, and I'm sure the rest of the industry  
11 doesn't, as regards what would be the specifics.

12 I mean, it's a thought, but a thought is a long  
13 way from a policy issue. We believe that we should move  
14 forward with completing the ongoing efforts. They have made  
15 some progress on 50.44, on fire protection. That still  
16 needs to be pursued, and then we need to focus on 50.46.  
17 The staff have already started to do that. I don't know the  
18 results of a meeting yesterday.

19 We think that we should -- 50.46 is a very large  
20 regulation and I've spoken to some of you before about  
21 50.46. We think that perhaps you can't address or attack  
22 the complete 50.46 in one hit. It has tentacles that go  
23 everywhere. So perhaps we can just break off a small  
24 portion of that or two small portions of it or perhaps just  
25 one large portion and see how far we can go with that.

1           And because of the work that's been undertaken by  
2 the Westinghouse owner's group and because of the benefits  
3 that it has, we think it's worthwhile pursuing the large-  
4 break LOCA and we're pleased to see that, from our meeting  
5 on June the 30th, it appears that the staff are moving  
6 energetically in that direction.

7           Once we've done that and we know how far we can go  
8 on 50.46, we can define where we want to go with some of the  
9 other regulations, and that really builds on a lesson we  
10 learned from the graded QA.

11           CHAIRMAN POWERS: Do you honestly believe there is  
12 sufficient base to actually work the fire protection area?

13           MR. HEYMER: Well, they've been working at it for  
14 several years now. Now, whether or not there is sufficient  
15 basis to bring it to closure.

16           CHAIRMAN POWERS: We've run into problems with the  
17 shutdown risk assessment because of the absence of a large  
18 base of empirical work with the risk assessment; gee, the  
19 base for fire protection must be no better than that.

20           MR. HEYMER: Unless you push forward and see how  
21 far you can go, I don't know. I'm not in the position to  
22 make a qualified response to that. All I know is we would  
23 like to see it continue to move forward and reach some  
24 closure.

25           DR. WALLIS: I think this is an interesting

1 approach. It looks as 50.44 is something which can be  
2 handled. You're asking how far can you go. My impression  
3 is that 50.46 might be one of those cases where you find you  
4 can't get there. It's much tougher.

5 MR. HEYMER: It may be so.

6 DR. WALLIS: What are your feelings about the  
7 feasibility of risk-informing 50.46?

8 MR. HEYMER: I think there's elements in there  
9 that you can risk-inform.

10 DR. WALLIS: Are they substantial or are they just  
11 on they edges?

12 MR. HEYMER: I think with the large-break LOCA, I  
13 don't know how far we can go with that, but I think we --

14 DR. WALLIS: It's very high profile.

15 MR. HEYMER: It's a high profile topic, but  
16 because it has so many links to other regulations, I think  
17 it's worthwhile pushing that and seeing how far we can go  
18 with that. I think some of the information I've seen so far  
19 says that we can probably make substantial progress in that  
20 regard.

21 Now, it's like everything else, if it's not the  
22 largest double-ended guillotine pipe break, what is it, and  
23 then you define it and some of the other issues.

24 It's more of a challenge than 50.44, I will agree,  
25 but I think you can get there, at least make some

1 improvement on what we've got or at least determine how far  
2 we might be able to go.

3 And because of its link to all the other  
4 regulations, I think once you've determined how far you can  
5 go with that, you can then say what can we do with some of  
6 the other regulations, because of the link that goes out  
7 from that.

8 And it may be that we don't, but we say, well,  
9 let's look at the coincident loss of off-site power and  
10 things like that, but I think that's the one we would like  
11 to focus on.

12 DR. KRESS: If, for example, it was concluded that  
13 large-break LOCAs of the guillotine type were of  
14 significantly low enough frequency that you really didn't  
15 have to worry about them, but instead, you worry about some  
16 other break size, because it has a higher frequency of  
17 potential breaks, what would the plants do in response to  
18 that type of -- I mean, what would this mean to the plants?

19 What is it they would do to their ECCS, for  
20 example, or to other systems with that realization?

21 MR. HEYMER: I think it comes down to -- and I  
22 think you're right, it's a good point. It's not eliminating  
23 the large break.

24 DR. KRESS: It's changing the --

25 MR. HEYMER: It's redefining it. But having got a



1 different break size is --

2 DR. KRESS: Then what do you do?

3 MR. HEYMER: Then what do you do? Well, perhaps  
4 you can relax some of the technical specifications, the  
5 surveillance testing, the start times, when do you really  
6 need the pumps to sequence on and how quickly do you need it  
7 to sequence on, when do you get the top of -- when does the  
8 level get to the top of the core and those sort of issues  
9 begin to come into play.

10 So I think it's when you start looking down the  
11 road at some of the links that come from that large break  
12 requirement, you then begin to see that perhaps there is  
13 something that we can do.

14 I think if people are under the impression you're  
15 going to take stuff out, it costs money to take stuff out.

16 DR. KRESS: Right. You don't do that. You're  
17 going to change --

18 MR. HEYMER: I think you're going to change  
19 something. And instead of going into a tech spec or an  
20 action statement, like now, you might have a little bit more  
21 time that takes the pressure off you and you may be able to  
22 come up with a different action or a different item.

23 DR. KRESS: Thank you.

24 DR. WALLIS: The great thing about large break  
25 LOCA is probably confidence. You say we have designed to

1 withstand the force that could happen, the biggest pipe.  
2 That's an easy thing to understand. You're still nibbling  
3 away at that. You're going to have to do some careful  
4 justification, not just to the NRC.

5 MR. HEYMER: And to ourselves. And, in fact, the  
6 debate that's going on within the industry is that very one  
7 at the moment.

8 This may sound a bit harsh, when you look at it,  
9 but we do see research as more of a risk-based theoretical  
10 approach. NRR appears to be using the PRA as an insight or  
11 as a tool certainly in option two.

12 However, I think when you get into option three,  
13 there is an issue of understanding that we are risk-informed  
14 and what's important perhaps in a risk-informed world isn't  
15 what was important in a deterministic world, and perhaps  
16 there is what some people have termed a letting go issue and  
17 the letting go issue is on both sides of the divide, both  
18 from an industry and an NRC perspective.

19 But I think we're not in a position now to go on a  
20 risk-based approach at all. We might be sometime in the  
21 future. But if you look at the risk-informed, especially if  
22 you start looking at option three, I think you've got to  
23 speak to the some of the issues that you raised. It's  
24 communication and an education process of what does this  
25 mean and, okay, the last 30 years, you have relied on this

1 and that has been important, now it isn't so important and  
2 both the regulator and the licensee personnel need to  
3 understand that, because otherwise you're not going to get  
4 there. So it's an education and communication process, as  
5 well.

6 I guess until recently, we thought the discussions  
7 on option two focused predominantly on low safety-  
8 significant functions and SSCs. I think that's slowly  
9 changing and that may be an issue that we raised before  
10 about some of the cultural activities.

11 I spoke about providing some -- we've got an  
12 action underway in the industry to try and provide updated  
13 information to the agency on PRAs, so that we base our  
14 decisions on the latest analysis that is being done.

15 And I guess moving forward, we think that there is  
16 skepticism out in the industry about risk-informed  
17 regulation, what does it mean, is it just going to be a one-  
18 way street, and it's interesting, I listened to the NRC  
19 staff management and I sat in on a number of the meetings  
20 and I hear the NRC staff, for example, in option two space,  
21 saying it's going to move into box three and very little is  
22 going to move into box two.

23 And yet when I talk to quite a number of the  
24 industry, apart from South Texas, they believe everything is  
25 going to move into box two and very little is going to move

1 into box three at the end of the day.

2 So I think it's important to move forward on these  
3 issues, for STP to get confidence. If we have a good  
4 conclusion on 50.44, and I think we'll probably get there  
5 once we've seen the technical basis for some of the things  
6 that are going in there and we've had a chance to resolve  
7 those.

8 The STP exemption request, I think that sends a  
9 clear signal to the industry that we are intent on moving  
10 forward.

11 With that, I'll finish.

12 CHAIRMAN POWERS: Thank you. Now I think we're  
13 going to hear from Mr. Christie.

14 MR. CHRISTIE: My name is Bob Christie. I'm the  
15 owner of Performance Technology in Knoxville, Tennessee, a  
16 consulting firm that does probabilistic risk assessment and  
17 reliability engineers, been doing that for about 11 years.  
18 Before that, I was an engineer for the Tennessee Valley  
19 Authority for 15.5 years. I don't see any unfamiliar faces  
20 at this horseshoe, so I'll assume that most of you have  
21 already heard me in the past.

22 Today I don't know whether I'm put in a position  
23 of coming up with the last that you're saving the last for  
24 best or you just wanted me to have such a short period of  
25 time that you didn't have to listen to me, and I leave it to

1 you to decide which is appropriate.

2 MR. BARTON: We'll leave you guessing.

3 MR. CHRISTIE: That's true enough, too. I just  
4 want to -- we had a pretty good meeting, I thought, on June  
5 29 with the subcommittee on the things I'm going to talk  
6 about today. I'm not going to go into the details of it.  
7 I'd just like to hit some of the key points.

8 I'd like to make sure that the full committee  
9 understands exactly what we're shooting for in the petition  
10 for rulemaking, and then give you a quick summary.

11 As you know, most of you know, and I think all  
12 probably know, we've had quite a substantive effort in the  
13 last three years on hydrogen control for nuclear power  
14 plants in the United States, under the umbrella of what used  
15 to be called the whole plant study, and there's a whole  
16 bunch of things that came out of that.

17 We had the Task 0 approved at Arkansas and then  
18 the Task 0 approved at San Onofre. I guess the thing that  
19 struck me the most about it or the key points were we  
20 shouldn't be concerned with design basis accidents. We must  
21 be concerned with severe accidents.

22 What we're really worried about here is  
23 containment integrity when the fission products are present,  
24 which goes back to severe accidents. Those are the ones  
25 that give you the fission products.

1           We've found the existing hydrogen recombiners and  
2           purge systems were ineffective. We've found that the  
3           existing procedures that are presently embedded in all the  
4           plants definitely can distract the operators are not optimum  
5           in any shape. And we also found that activation of any of  
6           the purge systems and portable hydrogen recombiners during  
7           severe accidents can be extremely detrimental.

8           So those are the kind of things that we did find.  
9           As you know, after the safety evaluation report at San  
10          Onofre, I sent a letter to the Commissioners of the Nuclear  
11          Regulatory Commission, I believe it was dated October 7, I  
12          think you all got copies and might have read it, where we  
13          pointed out that we do have a safety concern and that we  
14          needed to make changes and we suggested that the changes  
15          could be made in the following fashion.

16          The letter to the Commissioners was converted into  
17          a petition for rulemaking in November of 1999, through the  
18          approval of both, I guess, the Commissioners and myself, and  
19          that's where it is today.

20          We have a petition for rulemaking on 10 CFR 50.44.  
21          It was turned into a petition in November and noticed in the  
22          Federal Register I believe January 12, 2000.

23          We have made some changes. I want to talk to you  
24          about these changes right now. These are the changes that  
25          we made.

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1           There is an existing 10 CFR 50, Appendix A,  
2   Criterion 41, which is containment atmospheric cleanup. So  
3   if you read it, the existing one today, you find that you  
4   have systems control, fission products, hydrogen, oxygen and  
5   other substances that may be released into containment shall  
6   be provided, as necessary, to reduce, consistent with the  
7   functioning of other associated systems.

8           The concentration and quality of fission products  
9   released to the environment following postulated accidents  
10   and control of the concentration of hydrogen and oxygen and  
11   other substances in the containment atmosphere following  
12   postulated accidents to assure that containment integrity is  
13   maintained.

14           What we're worried about is severe accidents and  
15   not design basis accidents and what we're worried about is  
16   the containment integrity. What we looked at here was we  
17   deleted all this stuff about postulated accidents, because  
18   we were not worried about the design, we're worried about the  
19   severe.

20           And what we added was the fact that we should be  
21   paying attention to the severe accidents and we should be  
22   worried about containment integrity.

23           So our change to the general design criteria was  
24   remove the parts that refer to the postulated accidents and  
25   substitute for that an addition which would say that we want

1 to assure containment integrity is maintained for accidents  
2 where there's a high probability of fission products.

3 So this addresses our key points. Any questions?  
4 Because we had a few questions in the subcommittee.

5 DR. APOSTOLAKIS: Now, this brings up the question  
6 of this very theoretical versus pragmatic approach. It  
7 seems to me what the staff is proposing is pragmatic in the  
8 sense that they are telling you what reactor containment  
9 integrity means. Then they're giving you a number.

10 MR. CHRISTIE: Can we address that in one of my  
11 last slides?

12 DR. APOSTOLAKIS: Sure.

13 MR. CHRISTIE: If we're talking about containment  
14 integrity, I address it in the last slides.

15 DR. APOSTOLAKIS: Okay.

16 MR. CHRISTIE: But, again, we're shooting for  
17 severe accidents and we're shooting for containment  
18 integrity and we change it in the general design criteria,  
19 and that's what we thought we did.

20 We then had -- there are parts of the existing 10  
21 CFR 50.44 that have to do with inerting containments for  
22 MARK 1's and MARK 2's and there are parts of the existing  
23 things that say you've got to have igniters. Well, it says  
24 you've got to contemplate a 75 percent metal-water reaction  
25 for the Mark 3's and the ice condensers, which result in you



1 having to have the igniters.

2 We left them alone, didn't change a bit.

3 Okay. What we said was, okay, we're going to  
4 remove all the existing post-LOCA requirements from the 10  
5 CFR 50.44 and we have the inerting for the MARK 1's and the  
6 2's and we have the igniters for the MARK 3 boilers and for  
7 the ice condensers, what are we going to do for the large  
8 dries?

9 So we changed and added a section that says what  
10 the large dries are going to do is check their containment  
11 capability to ensure that for the -- and I forget the words  
12 exactly what we said -- can withstand, without any hydrogen  
13 control system, a hydrogen burn for accidents which have a  
14 high probability of causing severe reactor damage.

15 So what we're doing here is, again, we're going  
16 back to the focus on severe accidents and we're saying for  
17 severe accidents of high probability, you should check your  
18 containment. What we have done is, in previous work -- and,  
19 again, this addition is predicated on all the previous work  
20 we had done on the large dry containments, because as part  
21 of IDCOR for the industry, the industry degraded core  
22 effort, as part of the severe accident analysis that the NRC  
23 did after Three Mile Island, we had a heck of a lot of  
24 evaluations of the large dry containments.

25 What we did was we convinced ourselves that the

1 large drys could withstand the burns without the recombiners  
2 and the purge systems, that just the inherent capability of  
3 the containments was good enough.

4 We also evaluated them with respect to the backfit  
5 rule, the 50.109, to determine whether or not they had to  
6 have the igniters in them and the evaluations showed that  
7 they weren't going to -- the igniters in the large drys were  
8 not going to meet the requirements and so we don't have  
9 them.

10 So this addition is to take use of all the  
11 information that was gained from IDCOR and the severe  
12 accidents after Three Mile Island and to just put in place  
13 in the regulations exactly what goes on today; that is,  
14 large dry containments depend upon their containment  
15 capability and we don't have igniters or anything else.

16 It's all right to remove the recombiners, the  
17 purge, and we don't have to have the igniters.

18 It's also, in the existing 10 CFR, a provision  
19 which was added after the Three Mile Island accident in  
20 1979, that basically said we've got to have the high point  
21 vents in the reactor coolant systems, and we didn't change  
22 any of that, leave that alone, too.

23 So what we said to the Commissioners and everyone  
24 else is that through the efforts that we made on Task 0 for  
25 Arkansas and Task 0 for San Onofre, we had sufficient

1 knowledge to change the regulations for combustible gas  
2 control. This is the result of 20 years of work.

3 We said the focus must be on severe accidents.  
4 The petition for rulemaking basically is a combination of we  
5 went through the regulations and we looked and we said  
6 anything that was in there that was good, we retained it.  
7 Anything that we needed to add to the regulations to address  
8 where we are today, such as the requirement for the large  
9 dries to check their containment, we added it.

10 We deleted all the other parts of it, the  
11 recombiners and the purges and everything else that were in  
12 there. It's a very simple philosophy that we think is very  
13 pragmatic. It addresses what's going on and you can do it.  
14 You don't have to worry about a new framework, a new option  
15 three or anything. You can just go through and pull it  
16 through.

17 Now, the reason -- the basis for the judgment, we  
18 think, in the petition for rulemaking is the standard  
19 practices for petitions for rulemaking, which basically  
20 cover you must address the adequate protection provisions  
21 and you must address the backfit rule.

22 We have made the statements in both the Task 0 for  
23 Arkansas, the Task 0 for San Onofre, that the elimination of  
24 the requirements and the addition of requirements as  
25 proposed here is a risk-positive move; that is, the plants

1 will have less impact on public health risk after this  
2 petition is approved than before.

3 So we believe that we meet the requirements of  
4 adequate protection, because we are going to make the risk a  
5 little bit lower for the plants if the petition is approved.

6 We also say that the petition for rulemaking meets  
7 the requirements of the backfit, 50.109. This is just  
8 putting into place the work that's already been done. We  
9 don't have to add one more thing. We don't have to evaluate  
10 ice condensers or large dries or anybody for igniters or  
11 station blackout or anything else.

12 This petition for rulemaking meets the  
13 requirements for adequate protection and it also meets the  
14 requirements of a backfit.

15 It also risk-informs the regulation. It moves us  
16 away from the terms in the GDC-41 of postulated accidents.  
17 It moves us into severe accidents with high probability of  
18 causing reactor core damage, et cetera.

19 So that is our -- what we had in mind when we  
20 submitted the petition. Well, not when we submitted the  
21 petition. That was what we had in mind when we sent the  
22 letter to the Commissioners, solve a problem using existing  
23 work, get it done.

24 It doesn't seem to us to be very hard. It is now  
25 nine months after that letter was sent to the Commissioners,

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1 seven months after the petition for rulemaking was agreed to  
2 by both the Nuclear Regulatory Commission and myself. I  
3 guess it's five months after we published it in the Federal  
4 Register, we received the public comments, and on June the  
5 29th, we were told that the NRC staff has incorporated the  
6 petition for rulemaking into option three and is delaying  
7 any decisions on the petition based upon the recommendations  
8 that come out of option three.

9 It's unacceptable to us. This is a petition for  
10 rulemaking. It is not voluntary. It covers all plants. It  
11 meets all the requirements that you have to have for a  
12 petition for rulemaking.

13 That's all I got to say.

14 CHAIRMAN POWERS: Do the members have any  
15 questions? Thank you, Mr. Christie.

16 I want to move now onto the third item on our  
17 agenda, the assessment of quality, the probabilistic risk  
18 assessment, Dr. Apostolakis.

19 DR. APOSTOLAKIS: This is the quality of the PRA  
20 in the absence of the ASME standard, or approval of the ASME  
21 standard and the industry certification process. Right?  
22 The way I understand this.

23 So the staff has prepared a document that has been  
24 sent or will be sent to the Commission?

25 MS. DROUIN: The copy of the SECY that you have

1 received has been rewritten. So we're going to have to get  
2 you the new version.

3 DR. APOSTOLAKIS: So the Commission has not seen  
4 it yet.

5 MS. DROUIN: No, it has not gone out.

6 DR. APOSTOLAKIS: When is it due up there?

7 MS. DROUIN: It is due the end of this week.

8 DR. APOSTOLAKIS: So we don't have the final  
9 version.

10 MS. DROUIN: No. You do not have the final  
11 version.

12 DR. APOSTOLAKIS: And when will we see the final  
13 version?

14 MS. DROUIN: Hopefully tomorrow, but it's going to  
15 depend on what comments I get back today.

16 DR. APOSTOLAKIS: So that may have an impact on  
17 our decision to write a letter or not. Are you requesting a  
18 letter?

19 MS. DROUIN: I think we're requesting a letter.  
20 Tom walked out the door. My understanding is that we are  
21 requesting a letter on this. I thought that's what we said  
22 at the last one.

23 CHAIRMAN POWERS: Please go ahead.

24 MS. DROUIN: My name is Mary Drouin, with Office  
25 of Research. At the table with me is Gareth Parry from NRR.

1 I don't want to go a lot into the background, and  
2 I'm going to have to make an apology up front. When I came  
3 in this morning and punched the button to print the file, I  
4 punched the wrong button. So you're seeing an old version,  
5 not the corrected version of the viewgraphs. So I apologize  
6 up front for the mistakes in the viewgraphs.

7 DR. APOSTOLAKIS: Let me understand. Is the set  
8 of slides you are presenting based on the new revised  
9 version of the document?

10 MS. DROUIN: Yes.

11 DR. APOSTOLAKIS: Okay.

12 MS. DROUIN: Yes. They are based on the new  
13 revised version, but you'll see the mistakes in the slides  
14 as we go through.

15 DR. KRESS: They're just typos, you're saying.

16 MS. DROUIN: I'm sorry?

17 DR. KRESS: They're just typos, you're saying.

18 MS. DROUIN: Typos and some bullets. It's not a  
19 big deal. I just --

20 DR. APOSTOLAKIS: So we'll see the real you now,  
21 right?

22 MS. DROUIN: Excuse me?

23 DR. APOSTOLAKIS: Nothing.

24 CHAIRMAN POWERS: The idea that Mary makes  
25 mistakes is so new for me, I'm stunned.

1 DR. KRESS: We can't accept that.

2 DR. APOSTOLAKIS: There was never any doubt. I  
3 want to bring you into the general game here.

4 MS. DROUIN: Just real quickly, on the background,  
5 there was a GAO report that indicated the need for standards  
6 and they've been talking about this for quite some time.

7 Also going on is PRA standards that are under  
8 development by ASME, ANS and NFPA. ASME is doing a standard  
9 for full power level one internal events, excluding fire,  
10 with a limited level two.

11 CHAIRMAN POWERS: Explain that to me. I mean,  
12 we've had this fiction going on for some time that fire is  
13 some sort of an external event visited upon plants by an act  
14 of God, and I actually know how it happened.

15 It happened because when people first did these  
16 things, they forgot about fire and they said, oh, well, no  
17 problem, we'll just add it in to this external thing we're  
18 planning to do.

19 But isn't it time to get rid of this fiction and  
20 understand that fires actually happen in these plants as  
21 normal operating occurrence?

22 MS. DROUIN: I can just give you what --  
23 historically, when I first got involved in PRA 20 years ago,  
24 fire was considered an internal event and it was called an  
25 internal event because at that point in time, internal



1 events were those failures internal to the component.

2 So since fire was a thing that was external, it  
3 was, therefore, called an external.

4 Over time, and where it happened I can't tell you,  
5 the definition for internal, now the boundary was not the  
6 component, became the plant. So those failures internal to  
7 the plant were called internal events and those causes --  
8 now, there's a little discrepancy there because off-site  
9 power has remained an internal event.

10 But right now, the way it has been defined is fire  
11 and flood is internal because the definition for internal  
12 has been the plant boundary.

13 DR. APOSTOLAKIS: The real question here is really  
14 do you -- I mean, the ASME standard is already out. We're  
15 looking at it. ANS is forthcoming.

16 Does the Commission want you to actually have a  
17 document like this given the eminent publication of all  
18 these standards? I mean, if you decide to accept, for  
19 example, the ASME standard, do you still need a document  
20 like this? Are you duplicating effort?

21 MS. DROUIN: No, we're not duplicating effort.

22 DR. APOSTOLAKIS: You're not. Why not?

23 MS. DROUIN: Well, can we go through it?

24 DR. APOSTOLAKIS: I think the time is such that  
25 maybe giving answers now on the fly is better.

1 MS. DROUIN: Well, I think we're going to talk  
2 about that.

3 DR. APOSTOLAKIS: Okay.

4 MS. DROUIN: There is also the peer review effort  
5 that has been ongoing and NEI has submitted their  
6 certification for staff review and you heard about the  
7 details of that this morning.

8 Then we had the SRM that asked us to address the  
9 issue of PRA quality. This is where you're going to see  
10 some -- that last little one is just a duplicate, so we'll  
11 cover up that mistake.

12 First of all, there's a wide variety of risk-  
13 informed activities going on and in looking at these risk-  
14 informed activities, we're using risk insights based on PRA  
15 results. We certainly want to have confidence in these  
16 results. We want to be able to be making safe, sound safety  
17 decisions based on technically defensible information.

18 So as --

19 DR. APOSTOLAKIS: The only comment that I have,  
20 Mary, that is of any substance and which I don't know how  
21 the new version addresses it, is that I would emphasize the  
22 decision-making process more. That this is really what  
23 defines quality of PRA.

24 And for example, in the forwarding letter to the  
25 Commission, under PRA quality, which is page three of the

1 letter, is it -- are you referring to it as a letter? I  
2 don't know.

3 MS. DROUIN: That SECY, the new SECY is totally  
4 different.

5 DR. APOSTOLAKIS: Well, let me tell you what my  
6 comment was. Maybe it's still there. Under PRA quality,  
7 you are saying PRA quality is determined by the following  
8 elements; proper scope, proper level of detail, proper,  
9 proper, proper.

10 What I'm saying is that really what determines  
11 what is proper is the decision that you're about to make and  
12 how robust that decision is.

13 MS. DROUIN: Don't disagree with that.

14 DR. APOSTOLAKIS: You disagree?

15 MS. DROUIN: I do not disagree with that.

16 DR. APOSTOLAKIS: And then you are actually  
17 elaborating on that very well in section three of the  
18 report, I guess, of the SECY, where you are actually talking  
19 about -- the title is "PRA Quality and Risk-Informed  
20 Regulation," where you are giving examples and you are  
21 actually saying flat out because the reliance on PRA results  
22 will vary from decision to decision, the quality of the PRA  
23 must be judged in the context of the document process.

24 My comment is that this should be way up front and  
25 that resolves a lot of the problems.

1 In other words, if I improve my model on  
2 something, is that going to change the decision? That's  
3 really the question here.

4 If somebody has this thing about human recovery  
5 actions, okay, I go and spend a ton of money doing that, is  
6 that going to change the decision I'm making now?

7 And I think this should be the ultimate guidance.  
8 And I think, as I say, you are discussing it very well  
9 inside the report, but I think it should be also up front as  
10 that being the ultimate guidance.

11 Now, there is -- if I use that as a criterion, for  
12 example, you are saying, on page -- which I'm sure is not  
13 the same page anymore.

14 Okay. Somewhere there, you are oscillating. Page  
15 three, you are saying that in a risk-informed application,  
16 for example, where you are looking at standard technical  
17 specifications, when a licensee encounters an LCO, rather  
18 than shutting down the plant, they would be authorized to  
19 use the plant PRA to determine an appropriate configuration  
20 which represents an acceptable level of risk.

21 Applications of this type place a heavy burden on  
22 the quality.

23 Well, I'm not so sure. I'm not so sure, because I  
24 think determining an appropriate configuration does not  
25 require a multiple Greek letter method for common cause

1 failure. It does not require an ATHENA treatment of human  
2 error.

3 I think these things you can do very quickly, if  
4 we use the very code methods, identifying alternate paths of  
5 doing something.

6 Don't you agree? So I don't think that you need  
7 the -- you are relying on PRA results, but for this  
8 particular application, heavy burden is not something that  
9 is required.

10 MR. PARRY: I think you do need a pretty good PRA  
11 to enable you to evaluate all different configurations.

12 DR. APOSTOLAKIS: You need the accident sequences  
13 and the success paths and for these, typically, you don't  
14 need the very detailed quantification of uncertainties.

15 MR. PARRY: You're going down to a lower level of  
16 detail here and that's why you need the PRA to be -- it  
17 needs to have certainly a level of detail that's  
18 commensurate with the types of configurations that you're  
19 creating.

20 DR. APOSTOLAKIS: Yes. But for this particular -  
21 - I think this is an unfortunate example of a heavy burden  
22 of quality. That's my point. We don't have to debate it  
23 now.

24 But, again, think about it. For the  
25 configurations, identifying systems and going through that

1 path, I don't think you need all these fine details that  
2 another application you might want to.

3 I think what really matters is, is the system  
4 there or not. Now, the rest of it.

5 The next sentence doesn't make sense at all, but  
6 that's probably English. There are some applications which,  
7 because of the nature of the proposed change inherently,  
8 period.

9 MR. PARRY: Incomplete sentence.

10 DR. APOSTOLAKIS: It's crying for a verb. So  
11 that's my main comment. The rest of it I think is -- I mean  
12 -- I wouldn't do it unless the Commission asks you to do it.

13 Tell us why we need this, in the light of ASME,  
14 ANS and NFPA. This document helps you approve those other  
15 documents?

16 MS. DROUIN: It will provide assistance in that,  
17 yes.

18 DR. APOSTOLAKIS: I see. Because in my view, what  
19 you call PRA technical quality and you have a series of  
20 tables, I don't know that it helps anyone.

21 MS. DROUIN: Those are certainly what we call the  
22 function requirements of the PRA and that if you're going to  
23 come and play in the arena of a risk-informed activity with  
24 a PRA, you need to have those functional requirements.

25 Now, will those functional requirements, in and of

1 themselves, assure the quality or give you the confidence in  
2 the results?

3 DR. APOSTOLAKIS: They don't.

4 MS. DROUIN: No. You need to go to the next  
5 level.

6 DR. APOSTOLAKIS: For example, if I read this,  
7 parameter estimation analysis quantifies the frequencies of  
8 the identified initiators and the estimation process  
9 includes a mechanism for addressing uncertainties.

10 Why would anyone spend their time writing this? I  
11 don't think that you need to do all this. All you have to  
12 do is have a short thing that emphasizes the decision-making  
13 process, expand on your chapter three with the beautiful  
14 examples you have and some not so beautiful, to demonstrate  
15 what you want. But the rest is really a waste of your time.  
16 We have seen those things so many times.

17 The initiating event analysis should be  
18 sufficiently detailed.

19 MS. DROUIN: I think to PRA people, these things  
20 are probably evident. But I do think that when you come in  
21 and you're going to review something, you're going to review  
22 it against something. You're going to make a decision  
23 against something.

24 DR. APOSTOLAKIS: If you didn't have the ASME and  
25 ANS, I would agree. But since you have those coming up --

1 MS. DROUIN: And what are you going to review  
2 those against? What criteria are you going to use to judge  
3 the acceptability of those?

4 DR. APOSTOLAKIS: I think you're going to review  
5 them again your experience, Mary, not -- I guess what this  
6 says.

7 MR. PARRY: I think you need some structure to  
8 that review and I think that's what this provides. It  
9 provides the overall structure for the review that we will  
10 have to make of the standards.

11 DR. APOSTOLAKIS: But after you approve, say, with  
12 some exceptions, these documents, you will not need this  
13 anymore.

14 MR. PARRY: Presumably not.

15 MS. DROUIN: Presumably not.

16 DR. APOSTOLAKIS: There is a presumption about  
17 everything.

18 MR. PARRY: But that doesn't invalidate the use of  
19 it, though.

20 DR. APOSTOLAKIS: Anyway, my personal opinion is,  
21 I'm not necessarily criticizing you, because you're  
22 responding to an SRM, I think the important thing is what  
23 you have in section three and reemphasize the importance of  
24 decision-making and the robustness of the decision.

25 That is really the starting point for defining



1 quality, because depending on the decision -- I mean, you  
2 can go develop the multiple Chinese letter method now, but  
3 if my decision doesn't change, I don't care, and my PRA  
4 quality is as high as it can get for that particular  
5 decision.

6 That's my view. And it's already 11:25. So do  
7 you have anything important to say that I have not said?

8 MS. DROUIN: I, personally, disagree with you.

9 DR. APOSTOLAKIS: Okay. Go ahead.

10 MS. DROUIN: I think that I don't disagree with  
11 what you've said, but I think that equal to that, you need  
12 to define your level of your quality.

13 And what I mean by that is that if you come in and  
14 you say I'm going to be using PRA and I'm going to take  
15 results from that PRA to give insights, you need confidence  
16 in that.

17 Now, the level of confidence can absolutely vary  
18 with application.

19 DR. APOSTOLAKIS: Yes. It's the decision problem.

20 MS. DROUIN: I don't disagree with that. But I  
21 think if you lay out and say, okay, I'm going to rely on my  
22 CDF and I want to know what my dominant accident sequences  
23 are and you want to have confidence and you want to know  
24 where you don't have the confidence in that, you need to  
25 know what those weaknesses are, but you can't know those

1 weaknesses if you don't come in and say here is what I need  
2 to give me that.

3 DR. SHACK: That's sort of what I see as -- you  
4 know, when I look at the ASME qualification and he comes in  
5 with his two's and his three's, you still have to make the  
6 decision, okay, for this particular application, how do I  
7 know that having a two here and a one here makes it still  
8 acceptable.

9 MS. DROUIN: That's right.

10 DR. SHACK: I expected to see some sort of  
11 guideline that would do that, but I don't really see that in  
12 this document. But you're still going to have to come to  
13 some decisions, even if you accept the ASME thing.

14 It isn't like the good old days. I really  
15 expected this thing, when it first started, if you came in  
16 with an ASME certified PRA, it was good for just about what  
17 we want to use PRAs for. That would be if you had one  
18 single level.

19 But now that they've gone to the multiple levels  
20 and multiple elements have multiple levels, how you make  
21 sense out of all that for a particular application and  
22 deciding it's good enough almost seems to be going back to  
23 the old PRA by PRA review.

24 If you had some guidelines that said if it was  
25 level one in this and level two in this, it's okay for that.

1 DR. APOSTOLAKIS: Yes. You can only give  
2 examples, I think, of this. You can't predict.

3 MR. PARRY: I think that does depend on what you  
4 understand by those levels, which I think is one of the  
5 things that we're struggling with with the certification  
6 process, for example; what does a level one, two or three  
7 really mean.

8 DR. SHACK: But does this help you sort of  
9 understand -- that's what I couldn't see, that if this is  
10 used to review that, it doesn't seem to me to be addressing  
11 --

12 MR. PARRY: On its own, no. But I think it's the  
13 next level of detail beyond what you see in these tables  
14 that will help us determine what those things mean.

15 DR. SHACK: And are you preparing that?

16 MS. DROUIN: Yes.

17 MR. PARRY: Yes.

18 DR. APOSTOLAKIS: And that will be part of the  
19 document that you will send up by the end of the week?

20 MS. DROUIN: No, no, no.

21 DR. APOSTOLAKIS: But by the way, the SRM said the  
22 staff should provide its recommendations to the Commission  
23 for addressing the issue of PRA quality until the ASME and  
24 ANS standards have been completed.

25 So I come back to my earlier comment. This seems

1 to be a duplication. I mean, after you have the ASME  
2 standards, the Commission says, you know, go with those, if  
3 you approve them. You don't need this.

4 MS. DROUIN: If you approve them.

5 DR. APOSTOLAKIS: So I think Dr. Shack's comment  
6 is consistent with mine in the sense that it's really the  
7 decision-making process that ought to be emphasized here and  
8 now the ASME category one, two, three and this and that, or  
9 the grades that the industry is using, and give a few  
10 examples perhaps.

11 Now, the example that you already have here, you  
12 have a series of nice examples. When a licensee encounters  
13 an LCO, rather than shutting down the plant, they would be  
14 authorized to use plant PRA.

15 Now, could a category one do it here? Do I have  
16 to go category two or do I have to yes grade three or this  
17 or that?

18 I think that would be a useful example. I don't  
19 think that you should be burdened with the task of  
20 developing a general approach.

21 Then you have some other nice examples. The first  
22 -- let's see. They're so nice, I've lost them.

23 Okay. Increased power levels, you say, would  
24 result in less time for operator action during an accident.  
25 That was the power up rates for BWRs. This is an example of

1 how the extent of analysis required to support an  
2 application can be circumscribed and advanced by examining  
3 the inherent risk limitation.

4 I don't understand that sentence. But here you  
5 might say, well, maybe a category two PRA would be good  
6 enough for this. I don't know.

7 MR. PARRY: But I don't think we can make those  
8 decisions yet, since we haven't reviewed what those  
9 categories mean. So it's premature to put that in this  
10 document.

11 DR. APOSTOLAKIS: That is a valid point, yes.  
12 That is a valid point. But, again, given the document, the  
13 more decision-making process flavor.

14 MR. PARRY: Yes. I think one of the examples --

15 DR. APOSTOLAKIS: That would be a good one.

16 MR. PARRY: One of the examples which I would like  
17 to bring forward to you, which is in here, is -- and it  
18 directly relates to the decision-making processes -- is what  
19 a licensee should do given that he has reviewed his PRA and  
20 has found that perhaps he has certain uncertainties in there  
21 or he can't be too confident about the results.

22 What he can do is to compensate for that by  
23 restricting the degree of implementation. This was an  
24 example of what was done using the expert panels for  
25 categorization for things like IST, where, because they

1 didn't have a lower power and shutdown PRA or a fire PRA,  
2 they would look at the equipment that might be needed in  
3 those modes of operation for those initiating events and  
4 then treat them -- not put them in the low safety  
5 significant category, because they couldn't have any  
6 confidence from those contributions from risk, but they  
7 should be there.

8           And I think that's one of the things that we're  
9 going to have to struggle with, because people don't have  
10 complete PRAs. We're going to have to figure out a way of  
11 understanding how the licensee is compensated for these  
12 missing pieces of information, such that they're making good  
13 safety decisions.

14           DR. APOSTOLAKIS: In fact, Mary, I think your  
15 slide six says similar things. It's not inconsistent with  
16 the comments you've been getting.

17           MS. DROUIN: That's part of it.

18           DR. APOSTOLAKIS: Yes. But all I'm saying is that  
19 perhaps the first bullet of slide six should be really the  
20 driving force behind your review of the ASME, ANS and NFPA  
21 standards and the whole flavor of whatever document you  
22 prepare, because PRA is an exercise and you can't do  
23 experiments to confirm it.

24           The only connection with reality is the decision  
25 at the end. Right? It's a different kind of reality. It's

1 the decision. That's where you put your money where our  
2 mouth is. You are using these results to make a decision.  
3 So the decision then, working backwards, should determine  
4 the quality of the inputs. That's all. The rest is just -  
5 -

6 MS. DROUIN: I think the decision you're going to  
7 make is going to depend on want confidence you have from  
8 those results.

9 DR. APOSTOLAKIS: That's very true.

10 MS. DROUIN: And how well you can bring those  
11 measures into the process.

12 DR. APOSTOLAKIS: But the decision itself defines  
13 the level of confidence you need. That's what I'm saying.  
14 This is the robustness of the decision or the soundness, as  
15 we call it. Again, do I need the multiple Greek -- I mean,  
16 look at San Onofre. They don't use the multiple Greek  
17 letter, do they? They don't use the alpha, which is the  
18 latest and bestest. They use multiple Greek. Does it  
19 matter? Probably not.

20 MR. PARRY: Who needs multiple Greeks, right?

21 DR. APOSTOLAKIS: Especially today. I am done. I  
22 am done on that happy note. Mary or Gareth, do you have  
23 anything else to say? The rest we have seen. Come on,  
24 guys.

25 DR. WALLIS: George, you've -- I'm not quite sure

1 what you've been talking about. I thought we were going to  
2 talk about this document.

3 DR. APOSTOLAKIS: I believe that's the document,  
4 but they told us they revised it.

5 MS. DROUIN: We revised the SECY.

6 DR. APOSTOLAKIS: But that's part of the document.

7 MS. DROUIN: The attachment is being separated  
8 into two different attachments, but it's still saying the  
9 same thing.

10 DR. WALLIS: Well, this document is also being  
11 revised considerably, which I've had trouble with trying to  
12 know what to discuss.

13 But I think you did a good job on this document,  
14 although obviously it needed --

15 MS. DROUIN: Thank you.

16 DR. WALLIS: -- needed to be polished, because  
17 there's some funny places in there.

18 MS. DROUIN: I agree. We've been polishing it the  
19 past week.

20 DR. WALLIS: I'd like to -- this is a good step  
21 forward, in my opinion, in trying to be more specific about  
22 what you're looking for in a good PRA. I'd like to be  
23 helpful about a few points, but I think maybe I should just  
24 do that by sending you an e-mail or something, because the  
25 various points are not worth going through in front of all



1 the committee.

2 DR. APOSTOLAKIS: You can send an e-mail.

3 DR. WALLIS: The main point I have is that you  
4 make statements about PRA results are technically correct to  
5 ensure that or the codes accurately analyze the phenomena.

6 MS. DROUIN: I'll tell you, we struggle with these  
7 words.

8 DR. WALLIS: I don't know that you can ever ensure  
9 PRA results are technically correct. But what you do a good  
10 job of and you should do more of is emphasizing that  
11 uncertainty must be estimated and evaluated and not only in  
12 the inputs, but also in codes themselves.

13 There are uncertainties in the predictions of  
14 codes. So the points I'd like to see a little change in  
15 here is this emphasis on yes, you've got to quantify your  
16 uncertainties. It's not just input. It's also the process  
17 itself that has uncertainties in it, and let's quantify  
18 those as well.

19 I have some other details I'll send separately.

20 MS. DROUIN: Welcome them.

21 CHAIRMAN POWERS: Let me follow up on that. The  
22 emphasis on the quantifications of uncertainties is part of  
23 the concept of quality. And when we look at the discussions  
24 of PRA, there are lots and lots of discussions in which  
25 people say, oh, yes, as an after thought, we've got to worry

1 about the uncertainties.

2 We look now at the kinds of products that are  
3 being produced by these panels on producing standards for  
4 PRAs and they seem to have lots and lots of contortions to  
5 avoid saying the term thou shall quantify uncertainties.

6 They do that and have a graded process. They say,  
7 yes, at the very best level, thou shall quantify thy  
8 uncertainties and everything that they allow less than that,  
9 there's contortions of language around that.

10 Can you tell me what you think about that  
11 contortion of language?

12 MR. PARRY: I'd like to volunteer.

13 CHAIRMAN POWERS: Well, I'm particularly  
14 interested in what she says, because she's a member of one  
15 of these contorting language bodies.

16 MS. DROUIN: That part I am not. No, no. I plead  
17 innocent to that.

18 CHAIRMAN POWERS: Let me tell you about being on  
19 one of these bodies, writing standards. You get branded by  
20 the product of that standard, whether you --

21 MS. DROUIN: I realize that, but I'm one voice of  
22 18 on that team.

23 MR. PARRY: I actually think it's appropriate to  
24 treat uncertainties in the right way, and that is that the  
25 reason that you are analyzing uncertainties is to understand

1 how well you know the results and how much confidence you  
2 can have in using it.

3 So I am not upset to find no insistence on  
4 quantifying all uncertainties in the sense of propagating  
5 uncertainties through the analysis. I think what's more  
6 important is to do it when you can, but to understand where  
7 your sources of uncertainties are and how they can influence  
8 the result.

9 And that, I think, those statements are in these  
10 standards, I believe, in terms of interpreting the results.  
11 I'm not sure, but if they're not, they should be.

12 CHAIRMAN POWERS: I really don't understand. What  
13 good is it for me to know that something is uncertain if I  
14 have no idea what the magnitude is?

15 MR. PARRY: No, you have to have some  
16 understanding of the impact, I agree. I think what I'm  
17 concerned about is that I hear a lot of statements that you  
18 have to propagate all your uncertainties and I think that's  
19 not possible. We know that's not possible.

20 For instance, for things like modeling  
21 uncertainties and completeness uncertainties, what we need  
22 to know is where our uncertainties lie and maybe some of the  
23 things just to get around them by restricting the use you  
24 make of the PRA results.

25 CHAIRMAN POWERS: Again, just knowing that there

1 are uncertainties in something is no help to me whatsoever  
2 if I have no idea what the magnitude is.

3 MR. PARRY: I didn't say that. I said you need to  
4 also have some idea of the impact of the uncertainty. I  
5 agree with that.

6 MS. DROUIN: And I don't think you have to go  
7 through and do a formal uncertainty analysis to get to what  
8 that impact is and I don't think you have to go and do what  
9 you saw in 1150.

10 CHAIRMAN POWERS: That really didn't help. Can  
11 you -- you know more about this than I do. Can you point to  
12 me a case where you think that an adequate understanding of  
13 the impact of uncertainties was done without doing some sort  
14 of quantification of them?

15 MS. DROUIN: The quantification, I think maybe  
16 it's just a semantic problem here. If you're looking at  
17 your modeling uncertainties and you've made some assumption  
18 on something and you've quantified your model with that  
19 assumption, we can go back and requantify it with the  
20 assumption the other way to see what difference you're going  
21 to get.

22 That's different than trying to put some kind of  
23 number to that modeling thing and do some kind of  
24 distribution through it.

25 MR. PARRY: As an example, it's more meaningful

1 probably to provide a seismic PRA, for example, I'm thinking  
2 back many, many years when we did a seismic PRA for the  
3 Limerick generating station. We had six different hazard  
4 curves.

5 It was more meaningful to look at the impact of  
6 each of those hazard curves individually than to combine  
7 them probabilistically and produce a huge distribution,  
8 which basically where you knew that the tail was being  
9 driven by one of the -- well, we knew by having done the  
10 separate analysis that the tail was actually being driven by  
11 one of the hazard curves.

12 So that way you learn more about what the impact  
13 of the specific uncertainty. I think it's that that I'm  
14 reacting to. I don't like to see --

15 MS. DROUIN: I'll give you an example, one that  
16 jumps out, in my mind, going back to 1150, was the service  
17 water system. The service water pumps were in a housing  
18 compartment that had louver windows and there was  
19 uncertainty whether, if those windows were open, whether or  
20 not you needed room cooling.

21 The analysis suggested that when those louvers  
22 were open, you did not need room cooling. So the analysis  
23 went forward with that assumption that room cooling was not  
24 needed when those louvers were open.

25 Now, we went back and did a sensitivity analysis

1 to look at that uncertainty and we did it, well, what if the  
2 louvers were open and you still failed, what was the impact  
3 of that. I mean, that's one way to deal with understanding  
4 the impact of that without going through and saying, okay,  
5 what is really the -- a mean value for that and what the  
6 distribution is and doing some kind of elicitation.

7 I don't think you need to go to that level. I  
8 think you look at your assumption and see what --

9 CHAIRMAN POWERS: Okay. I have a better idea of  
10 what you're talking about.

11 DR. APOSTOLAKIS: Dr. Lois has been waiting for a  
12 while to make a comment.

13 DR. LOIS: Lois, from the Office of Research. I  
14 just want to make a comment and probably get your feedback  
15 on your comments regarding the quality of PRA in the  
16 decision-making.

17 Through the IPE reviews, we found that based on  
18 our critique that the licensees revised in a more  
19 technically accurate versions the PRA and the finding was  
20 that there are accident sequences and the results sometimes  
21 were entirely different.

22 An example of that, a kind of glaring example is  
23 the Zion IPE, where the HRA was kind of totally screwed up  
24 and when they revised it, the new version, the new results  
25 were very different than the previous ones.

1           Now, if we come in and even for configuration  
2 control, we had the old Zion versus the new Zion IPE, I  
3 guess our decision-making will be entirely different, and  
4 this is where we -- our attempt here in the PRA quality, we  
5 put emphasis in the quality of the results to assist  
6 document, even at that level of detail.

7           And I don't know whether this multiple Greek level  
8 approach is the state-of-the-art versus non-state-of-the-  
9 art at I don't know what level, but accuracy of the method,  
10 I guess, is what drives the PRA quality.

11          DR. APOSTOLAKIS: The point is you may not always  
12 need to be state-of-the-art on every single item.

13          DR. LOIS: But the point here is the accuracy of  
14 the PRA, of the technical method used as opposed to the  
15 state-of-the-art.

16          If you are not using multiple Greek letter and you  
17 use the beta factors and you use them correctly, I guess  
18 that's where we're getting here, accuracy of the method  
19 employed as opposed to state-of-the-art.

20          DR. APOSTOLAKIS: Many decisions that really are  
21 insensitive to that particular choice.

22          DR. WALLIS: I don't see any problem. We can  
23 reconcile George's viewpoint and yours. I mean, quality is  
24 best measured by uncertainty and for some decisions, you can  
25 tolerate a lot of uncertainty. You can do a very crude PRA

1 and it's good enough. Other ones, you need to be much more  
2 certain about it and then you've got to be much more careful  
3 about the sources of uncertainty.

4 DR. APOSTOLAKIS: I'm beginning to believe that  
5 the standards, as we quantify, are completely irrelevant.  
6 What really matters is model uncertainties, success criteria  
7 and so on.

8 But since it's trivial to do it, might as well do  
9 it. I have nothing else. Do the members -- first of all,  
10 the staff, do you have anything to add to the beautiful  
11 discussion we've had?

12 MS. DROUIN: At this point, I'd be scared to.

13 DR. APOSTOLAKIS: Do the members have any  
14 comments? The NRC staff? Public?

15 Back to you, Mr. Chairman.

16 CHAIRMAN POWERS: Thank you. I'm going to recess  
17 us now to the subcommittee room until 1:15.

18 [Whereupon, at 11:46 a.m., the meeting was  
19 recessed, to reconvene at 1:15 p.m., this same day.]  
20  
21  
22  
23  
24  
25



## A F T E R N O O N   S E S S I O N

[1:16 p.m.]

CHAIRMAN POWERS: Let's come back into session.

We are discussing the ASME effort and trying to develop a standard for PRA quality, a task that would daunt me, but these gentlemen I think have taken it on with enthusiasm.

So I'll turn to you, Professor Apostolakis, and help us through this challenging undertaking.

DR. APOSTOLAKIS: Thank you, Mr. Chairman. We have met with these gentlemen twice already. This is the third time. There was a workshop sponsored by the ASME, held on the 27th of June, that Dr. Bonaca and I attended.

Then we had a subcommittee meeting the 28th, where these gentlemen visited here, and we discussed the proposed standard.

We raised a few questions last time and to the extent possible, it would be nice if you could address them today. I don't want to preempt your presentation and start mentioning them.

So without further ado, Mr. Bernsen, I guess you will be the lead person, or Mr. Eisenberg? Okay. It's up to you. The floor is yours.

MR. EISENBERG: I'm Gerry Eisenberg, Director of Nuclear Codes and Standards at ASME. We thank you once

1 again for an opportunity to brief this august group.

2 With me today are Dr. Sidney Bernsen, Chairman of  
3 the ASME Committee on Nuclear Risk Management, and Karl  
4 Fleming, a member of the committee and the project team  
5 developing the standard.

6 I'd like to have Sid Bernsen start off the  
7 presentation.

8 MR. BERNSEN: Good afternoon. As Gerry said, I'm  
9 Sid Bernsen. We did have a presentation before the  
10 subcommittee a couple of weeks ago and I have some of the  
11 same material to go over again for the benefit of those who  
12 weren't here, if you think that's appropriate, but I don't  
13 want to take too much time in that area, because I know we  
14 want to have some additional dialogue.

15 So I'll go through this briefly. You have the  
16 package of material. If I forget anything, you can bring it  
17 up.

18 I did want to point out, of course, we don't have  
19 the large group that we had for the subcommittee, but those  
20 of us who are here, we're still individuals. Our comments  
21 don't necessarily represent the position of the committee,  
22 that CNRM means the Committee on Nuclear Risk Management,  
23 which is the ASME committee responsible for the development  
24 of this standard, or ASME.

25 We are still in the mode of seeking feedback and

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1 recommendations on the standard and as you found two weeks  
2 ago and we'll discuss today, we still have to define some  
3 position, our position on some issues are outstanding.

4 And as usual, we welcome your interest and your  
5 input.

6 Just to briefly review, the scope of our standard  
7 covers the level one PRA analysis, internal events, at-  
8 power, excluding fires, and a limited level two, sufficient  
9 for LERF evaluation.

10 The standard is being developed to support risk-  
11 informed applications, both the ASME codes and cases in ISI  
12 and IST and others that we have underway, as well as other  
13 regulatory and industry applications, and it's intended to  
14 support the use of existing PRAs, and that's an important  
15 point.

16 It provides a process for determining the ability  
17 of a PRA to support an application and it provides options  
18 for augmenting them through enhancement or supplementary  
19 evaluation.

20 The process we're using is our redesign process,  
21 where we use a project team that carries the product all the  
22 way through to completion. We also provide an opportunity  
23 for early review, and that's what we did a year ago, as  
24 we'll mention in a minute.

25 And eventually, when we feel we've resolved

1 essentially most of the important comments, it will be  
2 submitted to our committee for approval. The committee is a  
3 balanced committee, representing the most involved  
4 stakeholders.

5 CHAIRMAN POWERS: One of the things that I found  
6 surprising was the current version of the standard does not  
7 represent an evolution from the previous version I looked  
8 at. It's really quite a change.

9 Is this an activity that's approaching  
10 convergence? I mean, it doesn't look like it, to me.

11 MR. BERNSEN: I think so, and we'll cover that in  
12 the remarks to some extent and, if you want to, we can come  
13 back to it again. But, in fact, it is an evolution.

14 CHAIRMAN POWERS: I would help me, because I  
15 thought my previous examination would be a help, but it was  
16 like reading something entirely new.

17 MR. BERNSEN: Yes, we understand that. We  
18 provided some keys. But we can explain how we got to where  
19 we are.

20 Then it will be reviewed by our Board on Codes and  
21 standards and we intend to submit to ANSI for recognition.

22 Now, the current status, we issued draft ten in  
23 the spring of '99. We received more than 2,000 general and  
24 specific comments, 49 respondees.

25 The project team worked intensively to address

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1 these comments and then we issued draft 12 May 30th. It  
2 includes a white paper and, as George pointed out, we  
3 conducted a workshop and we had a review with the  
4 subcommittee a couple weeks ago.

5 Our projected schedule, August 14 the comments are  
6 due. The project team will work on the comments. We hope  
7 to have it ready for vote by the committee in October and do  
8 a parallel formal public review, so that early in 2001, we  
9 can have a final standard issued and approved.

10 CHAIRMAN POWERS: And what happens to this  
11 schedule if, by August 14, you get 2,000 comments from 49  
12 respondents?

13 MR. BERNSEN: Well, this is, of course, one of the  
14 problems, I should say, or maybe the virtues of standards  
15 that we need to reach a consensus. So we'll have to work  
16 very hard to resolve those comments.

17 In this particular case, we will probably take  
18 action to interact directly with the commenters and work to  
19 resolve the comments, and we have the option of deferring  
20 some things that are recommendations for the future, of  
21 deleting things that are controversial, whatever is  
22 necessary to resolve these.

23 But our anticipation is we won't receive as many.  
24 Our anticipation is they'll be more specific and our plan  
25 will be to work directly with the commenters to try to

1 resolve their comments.

2 So what we're looking for is where you've made  
3 comments, to the extent you can, have we resolved them,  
4 what's the acceptability of other changes, and what are your  
5 recommendations for the future, and we'd like to have  
6 whatever justification and support you can give us in these  
7 areas.

8 Now, what we plan to do today, and this is subject  
9 to your approval, is to talk very briefly about the general  
10 comments received on Rev. 10 which led us to the revision  
11 12, discuss the major changes from Rev. 10 to Rev. 12,  
12 briefly review the risk assessment application process,  
13 which is one of the feature parts of the standard, and then  
14 the approach that was used to develop the technical  
15 requirements, and Karl Fleming will talk about that.

16 If we have time, briefly talk about our peer  
17 review, and then we'd like to summarize and talk about the  
18 general questions we received in the workshop and from the  
19 subcommittee. So that was our proposed agenda, but we can  
20 adjust it.

21 To start with, Rev. 10, there were a number of  
22 specific or, let's say, general comments which really drove  
23 us toward the revision that you see. One had to do with the  
24 prescriptiveness and the difficulty in applying the process.

25 People did a computer word count on the word

1 "shall" and I think they came up with 900-and-some and they  
2 said that's an awful lot of requirements.

3 We took a hard look at these and, also, in terms  
4 of simplifying and streamlining the standard, we've used  
5 action statements rather than a lot of "shall." They're  
6 still, in a sense, requirements, but they're crisper and  
7 more precise and it's harder to count the "shall's."

8 CHAIRMAN POWERS: That doesn't resolve the issue  
9 of how do you know that your "shall's" are both necessary  
10 and sufficient.

11 MR. BERNSEN: I'm going to defer that to Karl, now  
12 or later.

13 MR. FLEMING: Karl Fleming, from the project team  
14 and the Committee on Nuclear Risk Management. The general  
15 way we do that is that we've distilled out of the 958  
16 "shall's" or whatever it was, a relatively small number of  
17 high level requirements that will be used as the final judge  
18 or perspective to look at any specific requirement, and  
19 we'll talk a little bit more in detail about that a little  
20 bit later on.

21 MR. BERNSEN: Then, of course, the other point  
22 being that the whole process is subject to the peer review,  
23 where there is an independent look at how one has  
24 interpreted the standard.

25 But I think the main answer to the question is,

1 this is a consensus process. We've had a lot of experts  
2 involved and we're getting a lot of input from the  
3 commenters, and this is really the only way one can come up  
4 with a balance between what is necessary and what is  
5 sufficient and what is practical.

6 CHAIRMAN POWERS: I was wondering, on the writing  
7 team itself, how many people -- the project team itself, how  
8 many of them have actually carried a PRA through and how  
9 many of them are what you would call users of PRA  
10 information?

11 MR. BERNSEN: Let's see. How many people do we  
12 have on the project team?

13 MR. FLEMING: Eighteen.

14 MR. BERNSEN: Eighteen. I would guess that about  
15 15 or 16 have done PRA work. Mary, do you have a better  
16 answer?

17 MS. DROUIN: I would beg to differ. I don't think  
18 that's accurate at all, and I'll just leave it at that.

19 MR. BERNSEN: Karl?

20 MR. FLEMING: Well, the 18 members of the  
21 committee include several recognized experts in PRA, a  
22 number of utility representatives who run PRA groups and use  
23 PRAs and apply them to various applications, representatives  
24 from people who have participated in the industry peer  
25 review certification process.



1           So there is, I think, a very broad base of  
2 expertise represented.

3           CHAIRMAN POWERS: I think I'd concede that, but it  
4 seems to me the problem you come down to is you're going to  
5 set up some "shall's" and somebody says how do you know  
6 those are necessary and that they're a sufficient set of  
7 "shall's."

8           And the only thing you could do is say, well, I've  
9 gotten all these people together that have run a lot of PRAs  
10 from beginning to end and they looked at this and they said  
11 this is the necessary and sufficient set. It's really the  
12 only defense you've got.

13           So the question is how many people on the  
14 committee have that credential of having done one from soup  
15 to nuts and have a good idea of what the necessary and  
16 sufficient is.

17           MR. BERNSEN: I think that's a good question and  
18 what I'd like to do is get a specific response to you on it,  
19 because we need to go back and research that.

20           But I think it is certainly a valid question, and  
21 we can do that both for the project team that's been writing  
22 the standard, as well as the committee that will be  
23 approving it.

24           But the comment was there was a need to  
25 distinguish among the grades of application and the PRA

1 capability. If you're at all familiar with what the  
2 industry has done in their certification process, where they  
3 essentially developed a four-grade system, there was a lot  
4 of encouragement to recognize that there are different  
5 grades of specificity and detail of PRA that are needed for  
6 different applications.

7 And then the need to recognize the primary use of  
8 the standard will be with existing PRAs and, as I said, the  
9 alignment with the industry peer review process.

10 CHAIRMAN POWERS: If I could come back and ask a  
11 question about the grades. You have categories, I guess you  
12 call them, three categories and you describe what those  
13 categories are.

14 But when I go through your tables and you have  
15 requirements, eventually you throw up your hands and say,  
16 okay, there's no difference between the requirements, but  
17 for a while, you had different things under each of the  
18 categories.

19 But when I go and look at that, it's, at best,  
20 subtle sometimes the differences in the subsidiary or  
21 supporting requirements that you have for those different  
22 categories in many, many cases. There's just no difference  
23 at all. It looks like a very forced fit, to me.

24 MR. BERNSEN: I'm going to let Karl answer it, but  
25 the -- yes. Let me let you answer it.

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1 MR. FLEMING: I think there's a question of  
2 presentation and we got some feedback a couple weeks ago  
3 that there were opportunities for us to enhance the  
4 presentation of this in the current draft.

5 There are some very distinct differences across  
6 those elements, which I'll try to highlight in a few  
7 minutes.

8 MR. BERNSEN: He's going to cover that in his  
9 presentation, but I guess the main point is if you'll  
10 notice, in the three categories, the supporting requirements  
11 are to be interpreted in terms of the intent of the  
12 categories. So there is a difference, even though the words  
13 may be the same.

14 At any rate, in response to the comments received,  
15 we had a significant restructuring, as you've seen in the  
16 standard. For one thing -- and I think we even mentioned  
17 that at the time that we talked to you a year ago, that we  
18 were going to move the application process forward in the  
19 standard, because we wanted people to focus on how to use  
20 the PRA.

21 We had this mandatory appendix with a generic  
22 database and we received a lot of unfavorable comments as to  
23 the completeness and the validity of some of the numbers and  
24 concluded that's something we ought to defer, at least. So  
25 we've deferred that for future action.

1 And we've approximated the range of possible risk-  
2 informed applications by the three categories, as we  
3 mentioned, and then we have the three-column presentation.

4 We have linked the PRA elements to the industry  
5 certification process. So where there -- you've got a  
6 question?

7 CHAIRMAN POWERS: I'll inject this question and  
8 you may have an answer here. The industry, in their  
9 certification, has four categories.

10 MR. BERNSEN: Right.

11 CHAIRMAN POWERS: Was there a reason for you not  
12 just to adopt their four categories?

13 MR. BERNSEN: Well, as I understand it, and maybe  
14 I shouldn't be the answerer, but their first category was  
15 essentially the IPE level. Right, Karl? And it was  
16 generally concluded that that was really not an appropriate  
17 category for any of these applications.

18 Things have gone beyond that. So, in effect,  
19 we've tried to pretty much emulate the two, three and four  
20 in their process.

21 MR. FLEMING: Yes. The fourth category that was  
22 not retained in the standard was in the certification  
23 process, primarily for an anchor point for historical  
24 references. It was viewed that all the utilities have, in  
25 some aspect or another, have moved forward in their PRA

1 programs to be able to do at least risk screening  
2 applications to support the maintenance rule and other kinds  
3 of activities.

4 So it was not considered to be fruitful to come up  
5 with requirements that no one is actually supporting these  
6 days.

7 CHAIRMAN POWERS: I guess that was something I  
8 struggled with a little bit to understand, in the  
9 categories, the maintenance -- for maintenance rule  
10 screening, is that what you intend by category one or is  
11 that category two?

12 MR. FLEMING: One of the lessons that we've  
13 learned in the last few weeks is not to try to go back and  
14 put specific applications into categories. I think it  
15 better conveys the content of what we have to try to  
16 describe the applications and the characteristics.

17 A brief thumbnail sketch is the original four  
18 categories that the certification process had, the first  
19 category was a PRA that was just barely adequate to meet the  
20 IPE requirements to find vulnerabilities.

21 The second category was capable for doing risk  
22 screening applications, where we could screen out  
23 insignificant items from your list of things to do, without  
24 having to take the numerical results of the PRA too  
25 seriously.

1           Then categories three and four were gradations of  
2 PRAs that were suitable for risk significance  
3 determinations; for example, a Reg Guide 174 determination  
4 that the risks are insignificant or acceptable or whatever.

5           So that's the general phenomena, and I'll get more  
6 into details later.

7           DR. BONACA: On this issue, for your information,  
8 there was a significant issue because category one, there  
9 was a characterization that typically do not impact safety-  
10 related SSCs, and then there were examples given for  
11 application, including the maintenance rule and some of us  
12 certainly objected to that, that there is a preempting of  
13 regulatory judgment, that essentially those are no safety  
14 significant applications, and I believe that that comment  
15 was received.

16           MR. FLEMING: Yes. We really have that message  
17 and we find it not really necessary to go back and try to  
18 backfit historical applications into different categories.  
19 It's more fruitful to talk about the characteristics of the  
20 applications that you need. That's what we'll be doing.

21           MR. BERNSEN: Of course, the peer review process,  
22 the certification process was proceeding and evolving in  
23 parallel with the standards. So that we did attempt to link  
24 our peer review requirements to the NEI document which is  
25 out now.

1 CHAIRMAN POWERS: My hat is off to the guy that  
2 had to go through and do that. That's a chore, the way  
3 you've got a number that links one to the other. It's good  
4 for the reader, but it must have been a chore to do.

5 MR. FLEMING: Most of last year.

6 MR. BERNSEN: I guess I should point out that it  
7 was an extensive amount of work to go from -- well, to go to  
8 Rev. 10 to start with.

9 DR. APOSTOLAKIS: What happened to 11? Nobody  
10 talks about 11.

11 MR. BERNSEN: Eleven was an intermediate product,  
12 internal only. But there was a tremendous amount of effort  
13 on the part of everybody, NRC staff, industry, consultants  
14 and lots of people. I'm really amazed at the amount of  
15 effort that was put into this product, even before ten and  
16 after ten, as well.

17 MR. FLEMING: To summarize, draft 11 was a step  
18 toward draft 12. It was a three-column format. We were  
19 going in that direction, but it hadn't reached the point  
20 where we were ready to send it out for public comment.

21 MR. BERNSEN: Draft 11 was really the first link  
22 between what we had in ten and the industry three-column  
23 approach.

24 Then we made some modifications in the application  
25 process that we think make it easier to use and we've had

1 some feedback on that.

2 I wanted to just briefly discuss the application  
3 process, unless you think we should bypass that. We've got  
4 a flowchart here that describes it.

5 DR. APOSTOLAKIS: We're going to have a lot of  
6 discussion when Mr. Fleming gets into the details, because -  
7 -

8 MR. BERNSEN: Right. The important thing here --

9  
10 DR. APOSTOLAKIS: So if you don't mind, Sid, maybe  
11 you can summarize.

12 MR. BERNSEN: Yes. In effect, it just goes  
13 through -- it's a process where you determine what the  
14 application is and whether you've got the right scope in  
15 your PRA. If not, you can enhance your PRA.

16 You use the section four that we have as your  
17 yardstick to determine the adequacy of your PRA for those  
18 applications or those parts, those elements that are  
19 necessary to support the application, and you can use  
20 alternative means, such as expert judgment or augmenting  
21 your PRA to cover those things that are missing from your  
22 PRA and perform the application. With that, I think I will  
23 go on to Karl's presentation of section four, because we've  
24 had --

25 DR. APOSTOLAKIS: The feedback perhaps.

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1 MR. BERNSEN: Do you want to do feedback first?

2 DR. APOSTOLAKIS: Yes.

3 MR. BERNSEN: Let's do feedback first. Fine.

4 DR. APOSTOLAKIS: On page -- what is it?

5 MR. FLEMING: It's 19.

6 DR. APOSTOLAKIS: What happened to 17 and 18?

7 MR. FLEMING: Interim products. They're part of

8 draft 11.

9 MR. BERNSEN: Now, the first page of feedback --

10 DR. APOSTOLAKIS: It's 19, right?

11 MR. FLEMING: Right.

12 MR. BERNSEN: I think we've lost some pages.

13 MR. EISENBERG: Kinko's lost some pages.

14 MR. BERNSEN: Kinko's lost some pages. So we

15 can't cover peer review, because we don't have it.

16 DR. APOSTOLAKIS: I have it here.

17 MR. BERNSEN: I'm kidding. Let's do feedback, and

18 the first page of feedback is material that Karl had

19 developed and I think I'd let him lead the discussion.

20 DR. APOSTOLAKIS: Okay.

21 MR. FLEMING: This is feedback that we got at both

22 the workshop and the ACRS subcommittee meeting. We had a

23 number of comments that the presentation material that we

24 gave at these two meetings seemed to bring across some key

25 points more clearly than was in the text in draft 12, and we

1 got a very clear message on that.

2 And one of the things we will be doing before we  
3 release this thing for a final vote is go back and  
4 incorporate those presentation concepts more clearly in the  
5 text.

6 MR. BERNSEN: Karl, I would suggest, why don't we  
7 throw that matrix slide up to show them, because I think  
8 that was one of the key things that we've developed since  
9 that time and intend to put in the standard.

10 MR. FLEMING: Right.

11 MR. EISENBERG: It's sort of a summary of the  
12 five-page presentation. It's in his handout.

13 MR. FLEMING: Right. That's sort of an interim  
14 product, but this was an example of some of the information  
15 that we presented at the two meetings that described the  
16 differences across the three categories of applications.  
17 That actually came in a sequence of five or six or seven  
18 slides, and we are preparing a table for incorporation in  
19 the draft of the standard that brings across these key  
20 points.

21 In a few minutes, I'll come back to this and go  
22 over it and explain it in greater detail.

23 The second item that we noted is that we got --  
24 from our perspective, we did get some encouraging positive  
25 feedback on the concept of using high level requirements

1 with supporting requirements derived into those.

2 We also got some comments that we still have some  
3 more work to do with respect to how you would go about  
4 applying specific applications to those three columns. So  
5 that's something that we still need to work on.

6 We get into understanding the differences between  
7 the three categories of applications, we do distinguish in  
8 the scope of these requirements as to whether they only  
9 apply to dominant sequences and risk contributors or a  
10 larger set, including more risk-significant sequences and so  
11 forth.

12 CHAIRMAN POWERS: That was one question that arose  
13 in looking at that first couple of sections. You speak of  
14 risk-significant and I was sitting there saying, gee, if I'm  
15 only going to do a level one analysis, how do I possibly  
16 know what sequences are the most risk-significant.

17 MR. FLEMING: What we mean by risk-significant is  
18 risk-significant with respect to core damage frequency and  
19 large release frequency. That's what we meant by risk-  
20 significant. And what we're trying to do --

21 DR. SHACK: Really you mean dominant.

22 MR. FLEMING: What we're trying to do is define  
23 the scope of how you would apply the requirements of the  
24 standard across the entire model of accident sequences and  
25 cut sets and common cause events and so forth.

1           So that in category one, we only need to apply  
2 these requirements to the dominant sequences and cut sets,  
3 but we go to categories two and three, we need to get more  
4 complete.

5           So it's a scope question and it's all within the  
6 context of the scope of the standard, which is core damage  
7 frequency and large early release.

8           But we've used these concepts extensively and we  
9 have yet to complete our deliberations and develop a  
10 consensus on how we define dominant and risk-significant.

11          There is some complex interplay between how we  
12 make these definitions and how we treat some of the  
13 requirements, for example, having to do with truncation and  
14 what the capabilities of the existing PRA models are with  
15 respect to truncation, and that prevented us from coming to  
16 a consensus at this time about how to define these terms,  
17 but we recognize that we do need definitions of these terms  
18 if we're going to continue to use these concepts.

19          So that's something that we need to work on.

20          In the presentations, we brought out the strong  
21 relationship in our concepts across these three application  
22 categories and how one would apply Reg Guide 1.174. In  
23 particular, we've made the point that a key feature that  
24 would distinguish a category three from a category two  
25 application is if you have relatively high CDF values and

1 high changes in core damage frequency that gets into this  
2 area of additional management attention that's mentioned in  
3 Reg Guide 1.174, where the decision much more strongly  
4 depends on the validity and the quality of the PRA.

5 So that relationship with Reg Guide 1.174 needs to  
6 be strengthened. That's the feedback we got.

7 The other concept that we've laid out in terms of  
8 how to distinguish across the three columns of requirements  
9 and commenting on Dr. Powers' earlier comments, there are  
10 quite a few detailed supporting requirements that are the  
11 same across all three columns.

12 There is a smaller set that are common maybe  
13 across two columns. The most common example is across two  
14 and three. But the one philosophy that we have built in  
15 there that's not fully implemented in a consistent fashion  
16 is that in category one, we're asking for point estimates,  
17 which could be conservative point estimates of core damage  
18 frequency and large early release.

19 In category two, we're asking for realistic mean  
20 values of CDF and LERF, with enough work on uncertainty  
21 analysis to make sure that your results do reflect  
22 reasonable estimates of means, and a more full  
23 quantification of epistemic and aliatory uncertainties in  
24 category three.

25 So that is one of the intentions of our

1 categorization process, but it's not fully -- there's some  
2 inconsistencies in the way in which that concept is  
3 implemented that we need to clear up.

4 CHAIRMAN POWERS: And each of the categories, each  
5 one of them says and thou shall have a full understanding of  
6 any uncertainties.

7 MR. FLEMING: Right.

8 CHAIRMAN POWERS: And I sit there and say, now,  
9 how in the world am I going to get any understanding of the  
10 uncertainties from these point estimates. From whenst do I  
11 derive a thorough understanding of uncertainties if I've got  
12 a bunch of point estimates?

13 MR. FLEMING: In category one, for example, the  
14 expectation is for a qualitative understanding of the  
15 sources of uncertainty that could be supplemented from doing  
16 sensitivity analysis and just understanding what key  
17 assumptions are driving your overall assessment, what  
18 success criteria issues and what other kinds of assumptions.

19 CHAIRMAN POWERS: I think I would be very careful  
20 about calling out that it's just point estimates in that  
21 first category. I think it's point estimates, maybe, but it  
22 is some sort of uncertainty analysis.

23 MR. FLEMING: Yes.

24 CHAIRMAN POWERS: Sensitivity analysis or  
25 something, because it's got to be more than just some points

1 in space.

2 MR. FLEMING: Absolutely. Absolutely. And there  
3 is an expectation that a thorough qualitative understanding  
4 of uncertainties is appreciated in the first category.

5 The next column that we had on this first slide  
6 was that in relationship to some previous documents that  
7 provided a more simplified, unambiguous definition of LERF,  
8 this draft of the standard offered some flexibility in how  
9 to define LERF, but the idea of having that flexibility was  
10 pointed out to be somewhat inconsistent with the scope of  
11 the standard, not going into the source term level two areas  
12 and level three areas that would really make that kind of  
13 definition stick.

14 So that was a good point that we need to go back  
15 and reflect on making the LERF definition consistent with  
16 the scope of the standard. So that's the first page of  
17 comments.

18 MR. BERNSEN: I'll take the lead on the next two,  
19 but you may want to help me.

20 One of the suggestions we had was why not publish  
21 a set of frequently asked questions and answers and I think  
22 that that probably is an example of, let's say, a broader  
23 question, which is people are going to need guidance on  
24 this.

25 So that after we get it out, we need to get on the

1 stick and make sure we find some ways to issue some guidance  
2 and other things that can go along with it for use on the  
3 standard, and we'll take that under advisement.

4 But, also, the specific point of if there are some  
5 questions that have been coming up repeatedly, we may want  
6 to issue something, I don't know exactly what form yet, that  
7 would be a frequently asked question and answer package.

8 CHAIRMAN POWERS: You understand that tables are a  
9 very succinct way of presenting the information, but, boy, I  
10 missed a little text explaining the first couple to me.

11 MR. BERNSEN: What they've told me, and I think I  
12 agree with it, at least in section four, is that there is an  
13 emphasis on what is required and not how to do it. We try  
14 to avoid giving methodology.

15 There were examples in ten. We've retained some  
16 of those in 12, but I agree with you.

17 Then there was a comment made that we should  
18 clarify what we mean by use of the standard with existing  
19 PRAs, and I think -- well, if it wasn't clear enough, we  
20 need to look at the words again and make sure that that is  
21 clear.

22 When we get into the application section, which is  
23 three, it's intended to be used with existing PRAs, but  
24 there is a question which I think is in the set that brings  
25 out the point that to what extent is an existing peer review



1 adequate, and we need to address that one, as well, because  
2 section three says it's intended to be used with standards  
3 that have been peer reviewed in accordance with the  
4 standard.

5 So we have that issue to still work on, but I  
6 think we're coming to some general agreement, although the  
7 project team hasn't thoroughly looked at it, nor has the  
8 committee.

9 There was a question of why we didn't publish the  
10 comments and responses. As I said, there were 2,000 of  
11 these. A matrix was prepared identifying all those.

12 Individual people were given assignments to handle  
13 different parts of the standard. Most of them completed  
14 their work in writing responses. We probably have drafts of  
15 about 85 percent of them.

16 But in looking at them, there was some  
17 incompleteness, a little lack of consistency, and some  
18 difficulty responding in terms of the revision and it looked  
19 like because of the preliminary nature of the document when  
20 it was issued and the extent of the comments, we decided  
21 that we would reserve that for the next round.

22 Then why not have uncertainty as a separate  
23 element, and I think Karl answered that one and I'll let him  
24 answer it again.

25 MR. FLEMING: I'm not sure if we had a chance to

1 really discuss what we're going to do with that particular  
2 comment, but right now, the intent of the standard is to  
3 cover the uncertainty quantification.

4 Well, the uncertainty -- okay. I've missed the  
5 thread there. The quantification of uncertainty really  
6 comes into play in many of the elements of the PRA. There's  
7 uncertainty issues in the initiating event, because that's  
8 where we have the frequency of initiating events covered.

9 There's obviously uncertainty in the data  
10 analysis, systems analysis, treatment of common cause  
11 failures, HRA, as well as the overall quantification  
12 process.

13 So uncertainty was one of these cross-cutting.  
14 It's a little bit like dependencies. It cross-cuts all the  
15 PRA elements and separating it out was viewed to be an  
16 unnatural artificial process. It's too orthogonal to the  
17 process.

18 MR. BERNSEN: The point that we discussed before,  
19 the standard shouldn't prescribe the relationship of  
20 categories through regulatory applications.

21 We had, in that section 1-5, given some examples,  
22 which we really intended to say this is typical of what  
23 people are doing, but it was read in a different way as the  
24 perception that we were, in the standard, prescribing what  
25 categories to use for what regulatory applications.

1           For that reason, we're going to revisit the words  
2 and make it very clear that that is not our intent. That's  
3 the regulator's intent and as Karl mentioned, we will  
4 identify the categories and the typical types of  
5 applications, but make sure that we don't presuppose we know  
6 the answer to the regulatory side of this.

7           DR. BONACA: One last brief question on this  
8 issue, and then no further questions, ever again.

9           Now, we have said that there are 16 experts on  
10 this panel. I believe that there were. And we have gone  
11 around and asked the licensees what they see when they  
12 remove equipment out of service, and they have told us that  
13 they see increases in core damage probabilities of up to a  
14 factor of ten, they don't even ask for management review and  
15 approval.

16           Beyond a factor of ten, occasionally they go to  
17 management for that. I have seen risk increases of a factor  
18 of 20 that we did not allow, but still that's a possibility.

19           I don't understand how this panel could conclude  
20 that these applications that are put as examples do not have  
21 safety significance.

22           The reason why I'm asking the question is that you  
23 may take it out of the text, but I am still concerned about  
24 this evidently widespread belief that the application of the  
25 maintenance rule and safety significance determination for

1 maintenance rule doesn't have safety significance or deserve  
2 a superficial evaluation.

3 I'm concerned about that. Where did it come from?

4 MR. FLEMING: If I might amplify, I think we  
5 didn't communicate well in what we were trying to convey  
6 there. Rather than, like Sid said, trying to legislate what  
7 PRA category a given activity falls into, what we're trying  
8 to convey is that there are certain activities that  
9 utilities are performing in which they have a rule to  
10 follow, it might be the maintenance rule or something else  
11 like that, that they have to follow anyway.

12 And they may or may not have maintained a PRA.  
13 They may or may not have decided to go down the risk-  
14 informed regulatory pathway which was set out as a voluntary  
15 exercise.

16 So in those kinds of applications, they're going  
17 to go and make these decisions anyway and they're going to  
18 primarily base their decision on deterministic input and if  
19 they have some PRA information to augment that process,  
20 they're going to bring it on for that.

21 DR. BONACA: That's exactly what I'm concerned  
22 about, that evidently there is a widespread belief that you  
23 can do these kind of things and you can use deterministic  
24 judgment, supplemented by category one PRA.

25 Anyway, I'm concerned about the thought process

1 within this working group that led to those kind of  
2 comments, which still are beliefs being expressed that -- I  
3 agree, they can be removed from the text, but evidently  
4 there is something there that is not understood.

5 MR. BERNSEN: I guess it's sort of a philosophical  
6 thing. We think about it, if people were using total  
7 deterministic decision-making in some of these areas and  
8 they had some risk information, should they not use it? So  
9 I think if you're coming from that perspective, you would  
10 say that some knowledge of risk to supplement what you're  
11 doing deterministically shouldn't hurt.

12 But again, I think there's enough variation here.  
13 I don't think the intent was to say that people should  
14 overlook significant changes in the risk profile. That was  
15 not the intent.

16 MR. FLEMING: If I might also offer -- and this  
17 was another feedback that we didn't get put down into the  
18 bullet. There was one, I think, perception that may have  
19 been created in the meetings a few weeks ago that I think we  
20 wanted to clear up, and that is that category one was not  
21 expected to be something that would not be respected as a  
22 quality PRA product.

23 Our category one that we have for applications was  
24 not a placeholder to put unrespectable pieces of work. Each  
25 of these categories was expected to be a quality PRA

1 product. It's just that its role in the decision-making  
2 process was somewhat less in category one than what would be  
3 expected for, say, a Reg Guide 1.174 application.

4 DR. APOSTOLAKIS: But you said, though, something  
5 that I think is very true, last time. That there aren't  
6 really any category one PRAs out there.

7 MR. FLEMING: That's right.

8 DR. APOSTOLAKIS: What the licensees have done  
9 always goes beyond what you call category one.

10 MR. FLEMING: At least parts. At least parts of  
11 all PRAs are beyond category one, in my opinion.

12 There's another problematic issue associated with  
13 Dr. Bonaca's comment, and that is that one of the things  
14 that we had in the draft was risk monitoring applications.  
15 And one thing we have to be very careful about, this  
16 standard does not address the whole plethora of issues to  
17 come into play when you try to do time-dependent risk  
18 calculations, like for risk monitoring.

19 So there isn't a single item in there that I'm  
20 aware of that really addresses the unique additional  
21 requirements on a PRA to do risk monitoring applications.  
22 It's an annual average CDF, LERF standard at this point.

23 DR. APOSTOLAKIS: Were you ever involved, in your  
24 prior life, in category one or two PRAs, Karl? I mean, I  
25 know you're on the Seabrook PRA. That's a category three, I

1 think, isn't it? Did you ever do a category one or two and  
2 do you think that what you did at the time conforms with the  
3 recommendations that the standard gives?

4 MR. FLEMING: I think that some of the -- there  
5 was a time when we were doing what we call a phase one or  
6 baseline PRA at the beginning of a full PRA project, where  
7 we would, in a matter of maybe a few person months of  
8 effort, put together a thumbnail sketch of what we thought  
9 the dominant risk sequences looked like and what we thought  
10 the important issues were for the plant and a rough idea  
11 where we thought the CDF would come out, but they weren't  
12 documented very well.

13 So I would say those might be category one.

14 DR. APOSTOLAKIS: But they were never really given  
15 to the client as a final product, were they?

16 MR. FLEMING: They were primarily used to make  
17 decisions about how to structure the rest of the PRA.

18 DR. APOSTOLAKIS: The rest of the PRA. So I'm  
19 really wondering whether any category one PRAs have ever  
20 been produced and used as such.

21 MR. FLEMING: Right. This gets to something that  
22 we've struggled with, and that is that -- and we need to  
23 work harder on this in the final version of the standard, is  
24 that we do not intend to put entire PRAs into categories.  
25 It was not our intention. We intend the utility to look at

1 what parts of their PRA and what parts of the risk spectrum  
2 need to be examined for specific applications and look at  
3 this question on an element by element, detail by detail  
4 basis.

5 So the whole idea of putting an entire PRA model  
6 into category one, two or three, we think, is not our intent  
7 of what we're trying to do here. We're trying to look at  
8 specific aspects of the PRA.

9 CHAIRMAN POWERS: From my perspective, that comes  
10 across pretty clearly. It was an interesting concept for me  
11 and when I puzzled over a little bit the different -- the  
12 way you treat initiators could be category one and  
13 everything else can be category two, but I understood what  
14 you were saying there.

15 MR. FLEMING: That's good.

16 CHAIRMAN POWERS: To the extent that you were  
17 looking for feedback, on saying did that come across, that  
18 came across that the entire PRA wouldn't be categorized.  
19 It's those five things.

20 MR. BERNSEN: And, again, I think the intent was  
21 to capture, in some way or other, what exists today out  
22 there, recognizing that in the future, this standard is  
23 setting a model that people are going to be looking at.

24 But if you want to be able to issue a standard  
25 that can be applied today for risk-informed applications,



1 then one needs to start by recognizing what exists today in  
2 the form of a PRA and provide the instruction, the guidance  
3 on how one uses that and to what extent you can use it and  
4 what you compare it with in order to use it for these  
5 applications.

6 So that's really the nature of this thing. We're  
7 describing, as we've been told, what the peer review teams  
8 are finding in existing PRAs.

9 If things didn't exist this way, then we wouldn't  
10 need these categories.

11 DR. APOSTOLAKIS: Would you explain the last  
12 bullet there?

13 MR. BERNSEN: The last one, define lower limits?

14 DR. APOSTOLAKIS: Define lower limits for category  
15 three.

16 MR. BERNSEN: I don't know whether I -- can you  
17 describe that better than I can? My understanding was that  
18 somebody -- several people indicated that the category three  
19 -- there was a question of what was the lower limit of  
20 quality in a PRA for category three and it wasn't clear that  
21 that was defined well enough.

22 Is that what you understood, Karl?

23 MR. FLEMING: Yes. The difficulty we're dealing  
24 with here is how to acknowledge that we have a continuum of  
25 application issues and decisions in which the importance of

1 the PRA sort of vary across a continuum and we've  
2 arbitrarily taken that continuum and broken it up into three  
3 regions.

4 And I think the best explanation that I can give  
5 between the category two and category three is when this Reg  
6 Guide 1.174, when you kick in this area where the risk  
7 significant -- the risk impacts and the baseline CDF get to  
8 the area where the decision-makers are concerned.

9 So that's probably the best answer to that  
10 question.

11 CHAIRMAN POWERS: Is it true, the impression I got  
12 that knowledgeable people might well disagree over the  
13 categorization of various elements of a PRA?

14 MR. FLEMING: My reaction to that would be that  
15 knowledge people could come up with equally reasonable ways  
16 to develop a categorization scheme that could be quite a bit  
17 different.

18 DR. APOSTOLAKIS: Go on.

19 MR. BERNSEN: The other point on that slide is the  
20 clarify when additional peer review is required, and that is  
21 something we're still struggling with, because even in the  
22 application process, we say that if your PRA is deficient in  
23 some area, you can enhance it by meeting the requirements of  
24 four for the application.

25 And the question is when do these supplements or

1 enhancements need to have a peer review and when don't they  
2 need to have a peer review, and we need to provide more  
3 definitive criteria for that.

4 CHAIRMAN POWERS: When you think about that, and  
5 it's an interesting question, the answer you come up on  
6 that, look at what you say about expert opinion and see if  
7 you can't factor some of that in there and when they need to  
8 get outside expertise in there.

9 That's going to be a troublesome area for people.  
10 So in the sense that peer review is outside expert opinion,  
11 it might influence what you write about expert opinion in  
12 there. I think that's a troublesome area.

13 MR. BERNSEN: Peer review is a little different in  
14 the sense that a peer review is not a detailed examination  
15 and it's not an audit. It's a knowledgeable group of people  
16 looking at what was done to the extent they feel is  
17 necessary to get a feeling for the whole PRA.

18 And, of course, an important part of their product  
19 are their notes and observations, which need to be used by  
20 the user of the PRA in these applications.

21 But it's really an overview of the product. It's  
22 not a detailed 100 percent check of everything that was  
23 done.

24 CHAIRMAN POWERS: Unlike many, many standards.

25 MR. BERNSEN: Pardon?

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1 CHAIRMAN POWERS: Unlike standards.

2 MR. BERNSEN: Right.

3 CHAIRMAN POWERS: You've got these nebulous  
4 qualitative terms in your requirements, like a reasonable  
5 understanding, a reasonably accurate, and it's the peer  
6 review that's the check on those things.

7 MR. BERNSEN: That's right.

8 CHAIRMAN POWERS: It plays an integral role here  
9 in a way that -- I mean, this is very distressing when you  
10 see these things in a standard, to see these reasonableness,  
11 which you can't find any way around it.

12 And the way you do that, the way you're handling  
13 that is with this peer review.

14 MR. BERNSEN: Right.

15 CHAIRMAN POWERS: It's a crucial thing.

16 MR. BERNSEN: In the area of expert judgment, now  
17 we're talking about a precise issue that needs to have the  
18 expert is the group, the team or individual that's making  
19 the decision and is thoroughly responsible for it.

20 So that I think there is some difference, but I  
21 agree with your observation. It is a separate point that we  
22 need to consider.

23 The next slide -- yes. And this is Mario's point,  
24 the concern with misuse of lower category PRAs. We are --

25 DR. BONACA: You mean the misuse being that there

1 is a presumption that you can develop a model that fits the  
2 need. And for that, we are wondering.

3 DR. APOSTOLAKIS: Why is that the misuse? Of  
4 course you can develop a model.

5 DR. BONACA: What I mean by that is that you think  
6 that you understand the problem; therefore, you say, okay,  
7 all I need are these pieces, because the standard finding  
8 has always been the PRA tells you more than you thought it  
9 would tell you.

10 DR. APOSTOLAKIS: That can happen in a category  
11 three, too. You think you're doing a category three and  
12 then you get a real expert that reviews it and says, no, you  
13 don't know what you're doing.

14 DR. BONACA: There ought to be some warning about  
15 that, because I think by the fact that you are setting a  
16 standard of this nature, you're like somebody -- I could  
17 mention anything. Somebody will use the models in areas  
18 where the model is not capable.

19 DR. APOSTOLAKIS: Let's not forget, though, that  
20 the standard is not the beginning of the end. I mean, the  
21 NRC staff will always be free to ask questions, to review,  
22 to do things.

23 So I don't see why, in some instances, when we get  
24 into trouble, we invoke the expert panel, and now we are  
25 loading the standard, we expect the standard to do

1 everything. They're going to review the thing and if they  
2 don't like it, they're going to send you 1,500 RAIs and  
3 they're going to overwhelm you.

4 So this is just a guidance to avoid that. That's  
5 the way I see it.

6 MR. BERNSEN: What we need to do is to be  
7 sensitive, to make sure we don't have something in there  
8 that appears to give permission when it shouldn't.

9 DR. APOSTOLAKIS: Right.

10 DR. BONACA: I'm saying there should be a brief  
11 discussion about the concerns with the issue and the  
12 pitfalls and be careful because it has to be a finding in  
13 correlation between the problem you're trying to address and  
14 the capability of the tool.

15 Even just stressing that issue places the  
16 responsibility on the user in making the determination, and  
17 I think it's important because it's not something new.

18 DR. APOSTOLAKIS: I'm not objecting to it.

19 DR. BONACA: Again, issues of a point kinetics  
20 model being used to do 3D.

21 DR. APOSTOLAKIS: Well, we could call up Mr. Hans  
22 Baker and tell him that, but he did use point kinetics. But  
23 I think you have a good point. I just want to bring back to  
24 the table the fact that this is not the beginning and the  
25 end and that in other instances, we rely a lot on an expert

1 panel.

2 So let's not forget that this is not something  
3 that tells you exactly what to do and so on.

4 Is there anything else on page 21 we want to  
5 emphasize? I think we've touched on most of these things.

6 MR. BERNSEN: Yes, I think that these have been  
7 covered. The issue of flexibility in the application  
8 process. Anytime you have a flowchart, it's important to  
9 recognize that things aren't always done in the logical  
10 order sequence that is depicted in a flowchart.

11 The clarification of the attributes for the  
12 different categories, which we're getting into, and I think  
13 that the next one is very important for us to look at, with  
14 regard to the flexibility permitted for an alternate peer  
15 review process.

16 We want to make it clear that first of all, we  
17 need to be -- as the last point points out, if we're  
18 referencing this NEI standard, we have to be convinced that  
19 we've reviewed it, it's acceptable. If it's not, to what  
20 extent it's not needs to be identified, and that is a piece  
21 of business that's important.

22 CHAIRMAN POWERS: And that's a pretty severe  
23 standard for reference.

24 MR. BERNSEN: If we reference it, it has to be  
25 available to everybody at reasonable cost and the committee

1 needs to recognize that they're approving that along with  
2 the document, if it's referenced the way it is now. We need  
3 to make sure the language is clear on that.

4 Now, what I'd like to do, at this stage, it would  
5 be useful to let Karl spend some time talking about the --

6 DR. APOSTOLAKIS: Am I in charge of the two hours?

7 MR. BERNSEN: You're in charge of the two hours.

8 DR. APOSTOLAKIS: Declare a break for ten minutes.

9 [Recess.]

10 DR. APOSTOLAKIS: We're back in session. I  
11 understand that we're going to go over each one of these.  
12 It's up to you.

13 MR. FLEMING: I tried to rearrange and summarize  
14 some of the key points from a few weeks ago in a few slides.  
15 Going back to Sid's comments, when we started with Rev. 10  
16 and all the comments we had with Rev. 10, it was our  
17 objective to move forward and our first goal and our  
18 intention was to retain all the technical elements of draft  
19 ten.

20 So if you believe there is something in draft ten  
21 that we haven't retained, that's something that we need to  
22 know about out. It was not our intention to take anything  
23 out that was covered in draft ten, but the method of  
24 presentation was changed substantially.

25 Now, having said that, we also made an attempt to



1 simplify the presentation of the standard and also to try to  
2 look at the balance of requirements across the different PRA  
3 elements. So you'll see many phrases and sentences that  
4 were in draft ten that you won't find in the current draft,  
5 but it was our intent to capture the technical essence of  
6 all those requirements in this draft.

7 The other key comment we were trying to address is  
8 we were trying to incorporate the insights and also concepts  
9 that were already being exercised as part of the industry  
10 peer review certification process.

11 Not only with respect to the process for defining  
12 PRA elements and quality attributes of a PRA, but also the  
13 body of knowledge that was being gained, because at this  
14 time, more than half of the plants have been subjected to an  
15 industry peer review process.

16 So a big job that we had which actually took place  
17 when we were working on draft 11 was to integrate the  
18 information from the certification process with the  
19 information of Rev. 10 and putting that into a format that  
20 would integrate the best technical issues from both  
21 requirements.

22 And in my opinion, I think you'll find that the  
23 technical requirements of this draft are more extensive than  
24 draft ten in the sense that there are a number of issues  
25 that were added from the certification process that may have

1 been implicit in draft ten that are now explicit. So we  
2 went through that process.

3 In order to get the certification process in  
4 there, which went with the concept of a graded approach to  
5 looking at quality in light of applications, we ended up  
6 restructuring the presentation of the technical requirements  
7 in section four substantially and that gave rise to the  
8 substantial differences that Dr. Powers noted earlier.

9 The way that structure is put together now, for  
10 each of the nine PRA elements, which are the same nine  
11 elements that we used in draft ten, we lay out the  
12 objectives of that element from the point of view of the PRA  
13 practitioner building that element of a PRA model, and then  
14 we captured the high level requirements that were covered in  
15 draft ten and also in the certification process that would  
16 be necessary and sufficient for qualified PRA practitioners  
17 to determine the quality of each element of the PRA.

18 And we tried to boil these down in terms of the  
19 relatively small handful of high level attributes and  
20 requirements that would have to be met for any category of  
21 application.

22 And this is something there was a considerable  
23 amount of consensus building and industry feedback to try to  
24 get these high level requirements correct, and this is the  
25 yardstick, I believe, that the peer review team would have

1 to use to determine the overall quality of the PRA.

2 The high level requirements was an important  
3 addition to this draft of the standard and it was trying to  
4 provide a context for trying to address the prescriptive  
5 comment that we had in the earlier draft.

6 And then for each of the high level requirements,  
7 we developed a set of PRA attributes for each element that  
8 gives us the philosophy for differentiating the detailed  
9 requirements or the supporting requirements across the three  
10 application categories.

11 And then we spent quite a bit of time, especially  
12 in the last six months, to try to define the application  
13 categories that are used for the three column tables, for  
14 the supporting requirements.

15 The other thing we worked on is to try to improve  
16 the consistency in the level of detail for documentation  
17 requirements, to make sure that on an element by element  
18 basis, we move the documentation requirements in with each  
19 element, so that there was a stronger relationship between  
20 the requirements for initiating events, for example, and the  
21 specific documentation requirements for that element.

22 That was all in draft hand, but we worked very  
23 hard to make it more consistent.

24 CHAIRMAN POWERS: One of the questions that you  
25 address, in the opening of the document, there are

1 initiating events initiated by fire are not treated.

2 Can you give me an understanding of why that is  
3 the case?

4 MR. FLEMING: It was simply a determination of the  
5 time and resources that the industry wanted to bite off and  
6 chew on at this particular time. There was no technical  
7 reason.

8 CHAIRMAN POWERS: Is it true that those fire  
9 initiators are sufficiently orthogonal to all other  
10 initiators, that it's fair to separate them out?

11 MR. FLEMING: I haven't personally been involved.  
12 Maybe Sid wants to respond.

13 MR. BERNSEN: And I'm not firsthand knowledgeable,  
14 but it's my understanding, at least at the time this  
15 started, that there was an assumption or presumption that  
16 NFPA was handling something in this area and I think -- was  
17 that one of the reasons for the referral, Gerry? Do you  
18 recall? I believe that was the case, and perhaps it needs  
19 to be revisited.

20 CHAIRMAN POWERS: Maybe it's something just to  
21 bear in mind as you think about revisions to this in the  
22 future. At some point, fires really ought to be factored  
23 into this thing.

24 MR. BERNSEN: We recognize that and that, in fact,  
25 is one of Karl's other assignments on the committee, is to

1 convene a task group to identify for us what future work we  
2 need to do, and that's got to be one of the things on the  
3 table, either NFPA or somebody has to do that.

4 It can't be ignored. But at this stage, that was,  
5 I believe, a presumption that we'd let NFPA do their thing.

6 CHAIRMAN POWERS: It's supposed to show up in  
7 Appendix B on NFPA 805.

8 MR. FLEMING: Now, on the issue of categories,  
9 there was a difficulty that I think we all experienced when  
10 we were working on draft ten, and that is the clash of  
11 cultures, if you will, between the PRA world, which is a  
12 world in which we have an open-ended scope, we're trying to  
13 get all the significant contributors to risk.

14 It's a state of knowledge driven process, and  
15 unless we agree not to continue to learn, our state of  
16 knowledge will continue to expand and the PRA will be an  
17 evolving process.

18 With that kind of inherent characteristic of PRA,  
19 trying to write necessary and sufficient requirements in a  
20 standard concept was really a clash of cultures and that  
21 manifested itself in too many "shall's," defining what we  
22 mean by shall, should and may, and we spent an inordinate  
23 amount of time in our committee meetings just trying to  
24 figure out how to talk to each other in terms of the  
25 language process and not enough time, as we probably should

1 have, working on the technical side of things, just as a  
2 personal observation.

3 But the idea of going to the application  
4 categories, while one of the motivations was to make this  
5 consistent with the certification process, the reason why  
6 the certification process went down that road, and I was  
7 supporting that effort when it was originally developed, was  
8 to recognize that you can't treat PRA quality by drawing a  
9 line in the sand.

10 You have to look at things as a matter of degree  
11 across a continuum and having any categories more than one  
12 was a conceptual necessity to get across the idea that we  
13 can't draw a line in the sand and say if you're on this side  
14 of the line, you have a quality PRA, if you're on the other  
15 side of the line, you have something different.

16 That overall process was very, very difficult and  
17 it came out in the form of the kind of comments we got on  
18 draft ten.

19 So in implementing these categories, we have some  
20 front matter that we need to work on in terms of improving  
21 draft 12, but these characteristics really differentiate the  
22 requirements across all three categories.

23 But even when you see the words being the same in  
24 the detailed tables going across the categories, there are  
25 really some fundamental differences in each of the

1 categories that really make them different, and a lot of  
2 those are explained in this slide here, which identifies  
3 five different aspects of the application of the PRA and how  
4 that leads you to differentiating the different categories.

5 The first one is to what extent the decision is  
6 relying on the PRA and category two is a risk-informed  
7 process in which we have a balanced set of deterministic and  
8 probabilistic inputs. Category two is the kind of thing  
9 that the people that wrote Reg Guide 1.174 had in mind.

10 But we also have situations where there is  
11 primarily a deterministic input into decision, where PRA is  
12 providing more of a supplementary support role, and that  
13 would be category one.

14 And we have a few situations where we may have  
15 high CDFs and high risk impacts, in which the need to  
16 understand and have trustworthiness in the quantitative  
17 results of the PRA is more than category two.

18 So that's one way in which we distinguish across  
19 these categories.

20 The second category has to do with how well we  
21 need to resolve the PRA results to be able to look at  
22 different applications. Category one are applications where  
23 we'd like to be able to do some basic screening. We want to  
24 be able to screen out a bunch of items off a list as being  
25 non-risk-significant and then go off and maybe do something

1 different with that set of requirements.

2       It's not really that important to know how risk -  
3 - what the numerical results are, just to know that there's  
4 broad categories of risk significance.

5       In category two, we might want to start ranking in  
6 some kind of way the -- in a quantitative way, systems,  
7 structures and components and be able to resolve the risk  
8 contributions to be able to determine what's risk-  
9 significant and what's not.

10       And category three, we need to be able to expand  
11 that in order to have a higher degree of confidence in the  
12 numerical results.

13       The third category deals with the degree of  
14 accuracy and how we deal with the overall quantification  
15 process.

16       In the first category, we tolerate conservative  
17 point estimates of risk. In the second category, we would  
18 like to have realistic mean values of what the risk  
19 parameters are. And in the third category, we need to be  
20 able to understand that for even some of the maybe non-  
21 risk-significant sequences and contributors.

22       The degree of confidence in the PRA results, I  
23 think that's somewhat self-explanatory.

24       Then the final one is really meaning to convey  
25 what's the stakes of the decision here, and that was



1 differentiated in terms of whether you were introducing  
2 changes to safety-related systems, structures and components  
3 or not.

4 So these were the three kind of categories that  
5 were --

6 DR. APOSTOLAKIS: Now, with the thought that we  
7 expressed at the subcommittee meeting about the 1.174, it  
8 seems to me that your first entry there could be modified  
9 now to say that under category two, you're using 1.174 away  
10 from the boundaries.

11 MR. FLEMING: That's right.

12 DR. APOSTOLAKIS: And category three, you're  
13 approaching the boundary.

14 MR. FLEMING: Absolutely.

15 DR. APOSTOLAKIS: So you better watch it. And  
16 category one doesn't belong anywhere in 1.174.

17 MR. FLEMING: That's right. That's one of the  
18 feedback we have and I think that's something we would agree  
19 with.

20 The other thing that differentiates all the  
21 requirements, and, again, this makes -- for any given aspect  
22 of the detailed tables, the supporting requirements, even  
23 when the words appear to be the same across two or three  
24 columns, there are really differences in the scope and  
25 application.

1           The category one requirements are intended only to  
2       apply to dominant accident sequences and contributors and  
3       what we mean by that is the majority, the major fraction of  
4       the risk profile, but maybe not finally resolved enough to  
5       make risk-significant determinations.

6           DR. KRESS: That major fraction, is that 51  
7       percent?

8           MR. FLEMING: More like 90 percent. In fact, we  
9       were working on some definitions of dominant and risk-  
10      significant and we were working with something like about a  
11      90 percent -- the vast majority of it, but maybe not  
12      sufficient to be able to make a Reg Guide 1.174  
13      determination.

14           All the risk-significant sequences might be like a  
15      99 percent kind of a number, just to give you a general  
16      flavor.

17           Now, we were working on these definitions and  
18      numbers. We don't want to get overly simplistic with these,  
19      but that's the general character of what we're talking  
20      about.

21           DR. KRESS: How does one know ahead of time  
22      whether he's captured the major fraction? I've got a PRA  
23      that I've stuck in a few sequences based on my intuition  
24      that these are probably the dominant ones that make up the  
25      major fraction, and then say, okay, I've captured it. I

1 don't have a number to compare it to without having a full  
2 PRA that captures all of it.

3 How does one make this determination that I've  
4 captured the major contribution?

5 MR. FLEMING: I think that's a very good question.  
6 There's two different thoughts here that we were trying to  
7 convey. One of them is how do you perform a category one,  
8 two or three PRA and what are the different elements in  
9 going through that process.

10 As you get to the quantification element, there is  
11 a -- I just spilled a little coffee here. I think somebody  
12 did a good job waxing the table, so I don't think we damaged  
13 the wood.

14 CHAIRMAN POWERS: These tables are protected  
15 against ACRS members. You can't possibly do any damage.

16 DR. WALLIS: Make sure you cut your significant  
17 fraction of it.

18 MR. FLEMING: I guess the first way I'd answer  
19 your question is really how do you know when your PRA is  
20 finished, first of all, and that involves performing a  
21 detailed review of your results, making sure you can explain  
22 the most important contributors, making sure you can explain  
23 what you might have been expecting to see and why you don't  
24 see it, the relationship between your design features.

25 And you have to go through a process like that

1 before you get to the point where you're done with even a  
2 category one PRA.

3 But the second notion was that as we start layering on  
4 specific requirements, like employ methods for treating  
5 common cause failures and HRA and so forth and getting down  
6 to detailed specifics, we wanted to limit the scope at which  
7 you had to worry about some of those details to portions of  
8 your risk profile.

9 So part of what we're trying to do here is limit  
10 the category one specific requirements to making sure that  
11 your dominant -- what you thought were your dominant risk  
12 contributors were adequately treated, so we don't have to  
13 chase questions about whether you use the MGL parameters on  
14 something that you knew was not a very dominant contributor.

15 MR. BERNSEN: Karl, let me try to answer it a  
16 little differently, because I asked the same question. I  
17 said I look at initiating events, which is what you start  
18 with, and how do I know whether I got all the dominant ones  
19 or the risk-significant ones.

20 And the answer I got was this standard is really  
21 not a recipe for developing a PRA in a vacuum. This  
22 standard is really one that says how do you -- you have an  
23 existing PRA of some value, of some significance, and you  
24 use that as your model and it's an iterative process.

25 So we're not writing a standard that says here's

1 how you write a PRA or you do a PRA. That's what I was told  
2 and, in my ignorance, I didn't know that beforehand.

3 Is that a reasonable explanation?

4 MR. FLEMING: I think that is, but it's also a  
5 fair question in the sense that when we wrote the standard,  
6 if you look at the high level requirements, for example, the  
7 concept of completeness comes into play in every PRA  
8 element.

9 There is a question of whether it's reasonably  
10 complete with respect to the initiating events that might  
11 take place, with the common cause failures, with the HRA  
12 issues and so forth.

13 So the completeness and the fidelity of the PRA  
14 with a plant model and the buy-in of the plant system  
15 engineers and operations personnel and so forth, those kinds  
16 of features are put all the way through the standard, such  
17 that when you get to the end, you should be satisfied you  
18 have a complete PRA.

19 Then you have to ask the question, how do I apply  
20 all these detailed requirements to which portion of my  
21 profile, because the PRA could be very, very huge in scope  
22 and you don't want to waste a lot of money putting very fine  
23 features of something that isn't very important to risk. So  
24 that's partly what we were doing by that.

25 So when you look at these, scope of coverage of

1 technical requirements, that really lends itself to  
2 differences that differentiate across all three categories,  
3 even when you see the words saying the same thing.

4 The next thing we did, sort of going from the top-  
5 down fashion deriving these technical requirements, is that  
6 we took the basic attributes of a PRA, things like  
7 completeness, fidelity of a plant with the models, the use  
8 of appropriate statistical methods and so forth, and we  
9 basically came up with the overall philosophy for how we  
10 were going to define the three categories of requirements  
11 for each element, and that's covered in a table in draft ten  
12 and it's been presented in these slides.

13 This is where you will see things like dominant  
14 and risk significant mentioned quite a lot. This is where  
15 we try to lay out our vision that we go from point estimates  
16 in category one to mean values with enough uncertainty  
17 analysis to understand that you have mean values in category  
18 two, and a full quantification of epistemic and aliatory  
19 uncertainties in category three.

20 Again, we have some inconsistencies down at the  
21 element level that we need to work out there, but that's the  
22 overall philosophy.

23 CHAIRMAN POWERS: One of the points at which I  
24 became very frustrated with you -- I subsequently became  
25 unfrustrated -- but was exactly on this table. You have

1 under category three identification and realistic  
2 quantification of initiating events. So I said, okay, that  
3 looks good to me, what less should I do in category one and  
4 two, identification and completely fanciful quantification  
5 of initiating events?

6 MR. FLEMING: Let me see if I can explain how we  
7 ended up with this, and this is probably not where we want  
8 to end up with the table. We were focused really on  
9 category two, and, again, category is what we attempted to  
10 draft ten, was to come up with the categories that would be  
11 the minimum categories to do Reg Guide 1.174 application.

12 So that's really what we were trying to do and we  
13 worked on -- what we intended to do here was we tried to get  
14 category two where we were happy with it and then we thought  
15 about how we were going to expand it and subtract it in the  
16 different categories, and we, frankly, went through a lot of  
17 evolution on that process of how we do this and I think  
18 we've made a lot of progress on that, but there's probably  
19 still some things we need to fix.

20 But in mostly category two, we talk about the need  
21 to do this for the risk-significant accident sequences and  
22 contributors. So identification and realistic  
23 quantification of risk-significant accident initiating  
24 events.

25 The choice of words for category three was to take

1 off the filter phrase of risk significant in recognition  
2 that you may have to extend this treatment somewhat beyond  
3 the risk-significant applications, depending on the  
4 particular application.

5 So we were trying to make category three somewhat  
6 more inclusive and I'm not sure if we conveyed the thought,  
7 but that was the logic behind that.

8 MR. BERNSEN: Let me explain. I think this is a  
9 case where global instructions sometimes get you in trouble.  
10 I tried to encourage the committee to avoid the use of the  
11 word "all" and originally the statement here was for all  
12 model sequences in category three, which is probably  
13 correct.

14 But since I told them to delete "all," they  
15 deleted "all" everywhere and maybe we need to put some  
16 "all" back in to convey the intent here.

17 But what the intent was, whatever things you  
18 model, you should have this understanding. Is that right,  
19 Karl?

20 MR. FLEMING: That's right.

21 DR. WALLIS: I thought that Dana was asking about  
22 the word "realistic." And everything should be realistic.  
23 Either it's --

24 DR. APOSTOLAKIS: There is realistic and  
25 realistic, though, Graham.



1 DR. WALLIS: But I want some measure for  
2 realistic. How do you know? Do you just recognize it's  
3 realistic or do you have some measure of it?

4 DR. APOSTOLAKIS: The way I see it is that an  
5 accident sequence is not a well defined concept. Accident  
6 sequence can be I have a loss of coolant accident, I lose  
7 injection of water, and I have a core melt. That's a  
8 sequence. And then I can go down to a very detailed  
9 description, this happens about this time, I begin to have  
10 corium and this and this.

11 So all these are accident sequences and at the  
12 higher level, I may not care that much about modeling the  
13 human recovery actions to great detail.

14 Now, that would not be a realistic model, and so  
15 on. So I think that the root cause of this is really the  
16 concept of accident sequence and initiators, everything that  
17 goes there, is really not a well defined concept.

18 MR. FLEMING: What we were trying to convey here  
19 is that we did not -- okay. First of all, we recognized  
20 that while it's easy to say that, of course, PRA, we try to  
21 be realistic and so forth, the practical reality is that  
22 there's a very, very heavy burden that comes with the  
23 attempt to be realistic.

24 So what we wanted to do in the standard was to  
25 introduce the requirement for realism in category two and

1 what that means is that in category one, there's a  
2 permissive application of conservative assumptions, as long  
3 as it doesn't distort the application that you're trying to  
4 deal with.

5 We can envision lots of applications where you can  
6 simplify the PRA by using conservative success criteria,  
7 conservative assumptions that would be adequate for  
8 screening out some valves or some breakers from some kind of  
9 a testing program or whatever, because the use of your  
10 conservative assumptions are carefully controlled and so  
11 forth and you're not taking the absolute values of your PRA  
12 seriously anyway.

13 But in category two, you're trying to make a delta  
14 risk determination or a risk impact determination.

15 DR. APOSTOLAKIS: I believe the word realistic --  
16 may you can replace it or augment it by adding something to  
17 convey this message, both what you said and what I said.  
18 There is realism and realism.

19 DR. WALLIS: Doesn't it mean more than either of  
20 you say? It means based on substantial evidence and not  
21 estimation.

22 DR. SHACK: It means the attempt not to be  
23 deliberately conservative.

24 DR. WALLIS: That's very different. If you know  
25 nothing, you can't very well be realistic. How much do you

1 need to know in order to be realistic?

2 DR. APOSTOLAKIS: That's fairly true. That's a  
3 better way --

4 DR. WALLIS: Or you have some evidence.

5 CHAIRMAN POWERS: I think George is right that if  
6 you take some words that you just used and help me  
7 understand that first category. This is the first table I  
8 run into, so it's very important to me when I read it.

9 MR. FLEMING: Right.

10 CHAIRMAN POWERS: And just say that the value of  
11 PRA comes when you do things as realistically as you can,  
12 and there's a limit to how realistic you can be at various  
13 stages.

14 So I want you to be realistic at all times that  
15 you can, but there is a point where the burden associated  
16 with trying to be very realistic outweighs the objectives of  
17 what you're trying to do and you may achieve those  
18 objectives by bounding analyses and whatnot, and in no case  
19 are you asking to be overly optimistic.

20 Just a paragraph or two that outlines exactly what  
21 you said. So much helps me through this table that I can  
22 understand the rest of the tables a lot better.

23 MR. FLEMING: I understand. It's important  
24 feedback, because what we were trying to convey here really  
25 was the mirror image of the complement of this, that

1 conservativisms were only permitted in category one and  
2 there's not a toleration of --

3 CHAIRMAN POWERS: In every case, I think you come  
4 down and you say, look, make sure your conservativisms aren't  
5 so excessive that they're distorting you out of the field of  
6 reality.

7 DR. APOSTOLAKIS: But it seems to me, Karl, that  
8 it's not just the word conservatism. I think that detail  
9 also is important. Again, the recovery actions. In  
10 category three, you may ask questions like how many people  
11 will be in the control room, is anybody else going to go out  
12 to the field and do this and do that and communicate.

13 Category two, you may treat them as a group. And  
14 in category one, you may even not bother. In fact, I think  
15 in the phase one PRAs that you mentioned earlier, I think  
16 recovery actions were not included. Sometimes they were  
17 completely omitted.

18 Now, that's not realistic at all, but for the  
19 purposes of this particular analysis, it was all right.

20 So I think in addition to the other things we  
21 discussed, some reference to the detail of the analysis I  
22 think would be appropriate here.

23 And I just gave you an example of recovery, but  
24 I'm sure there are other examples involving hardware and so  
25 on, where you may decide to go into more detail than in

1 other cases.

2 MR. FLEMING: Right. As you go through these two  
3 pages of attribute tables, the main difference across the  
4 columns stems from the concepts of whether conservative  
5 assumptions are permitted or not and the extent to which we  
6 want to apply the criteria to dominant or risk-significant  
7 or somewhat beyond risk-significant.

8 On the next page, in the quantification element,  
9 we also try to convey the notion that we're imposing the  
10 requirements for a full quantification of uncertainties in  
11 category three.

12 Category two, there's a comparable burden  
13 sufficient to come up with a reasonable basis for  
14 understanding that your point estimates are mean values or  
15 that you have reasonable mean values of CDF and large early  
16 release frequency, whereas in category one, conservative  
17 estimates of these parameters are acceptable as long as they  
18 don't distort the application.

19 DR. KRESS: Let me ask you about the internal  
20 flooding role there. Number one, it's the first time you  
21 pulled out a specific initiating event to deal with by  
22 itself and in category one, you say modeling of dominant  
23 flood sequences.

24 I'm not sure in this case what dominant means.  
25 Does it mean that if you take all the flood sequences, it's

1 the dominant one with respect to the contribution of flood  
2 or is it dominant with respect to overall CDF? The intent  
3 was dominant with respect to overall CDF.

4 DR. KRESS: That wasn't clear to me.

5 CHAIRMAN POWERS: I concluded exactly the  
6 opposite.

7 DR. KRESS: I did, too, actually. And the other  
8 question I have about it is if you replace the word flood  
9 with fire, wouldn't that be just as good for the fire? I  
10 mean, taking care of the fire there.

11 MR. FLEMING: From a purely technical and  
12 functional characteristic, internal fires, seismic events,  
13 other external events would fit into this structure by  
14 simply adding an appropriate row to the table.

15 And you made a good comment there, an interesting  
16 comment. We called out internal floods as a separate  
17 element and what is meant by that is that floods are, in  
18 most cases, an initiating event and all the requirements of  
19 the initiating event section would apply to your internal  
20 analysis of internal floods.

21 But we wanted to put there some of the special  
22 issues that come up with internal structural failures and  
23 flood propagation issues and so forth that come into play  
24 with that.

25 But the concept of this is that you have an

1 integrated model of internal floods and internal events that  
2 the special requirements are located in that section.

3 DR. WALLIS: How about human actions, you have a  
4 realistic model of human actions and I'm not sure that  
5 there's a science that is particularly good about predicting  
6 what human beings are going to do in accident situations.

7 So do we have a basis for being realistic or is it  
8 based on a lot of assumptions?

9 MR. FLEMING: I think a caveat that applies to all  
10 of this document is everything is written relative to the  
11 state-of-the-art. So I think PRA practitioners understand  
12 that one can go through each one of these elements and talk  
13 about the difficulties associated with the state-of-the-art  
14 and HRA is pretty widely recognized as being the soft  
15 underbelly or PRA in terms of the ability to predict what  
16 the operators will do and to be able to quantify the  
17 probabilities of HRA.

18 On the other hand, it's --

19 DR. APOSTOLAKIS: The truth of the matter is that  
20 in two or three key incidents, the operators acted much  
21 better than the PRA analysts would have modeled them.  
22 Brown's Ferry and Davis Besse. So it works both ways.

23 MR. FLEMING: Yes. It's difficult to capture both  
24 the positive and the negative contributions of the operator.

25 DR. APOSTOLAKIS: I mean, it's not a science in

1 the sense of natural science.

2 MR. BARTON: It should be more predictable now,  
3 because the two that you mentioned, Brown's Ferry and Davis  
4 Besse, were before EOPs and all kinds of detailed procedures  
5 once you get into accident sequences, which you really have  
6 now in place.

7 DR. APOSTOLAKIS: Also true. But to this day, we  
8 still don't give them credit for innovative action. The  
9 only thing is if they are expected to do something and they  
10 fail to do it, we model that. But they may go and use water  
11 from another source or something, procedures, we don't do  
12 that.

13 DR. KRESS: Since you called out human reliability  
14 analysis as a special row up there to deal with, I'm a  
15 little surprised you also don't have one for common cause  
16 failures.

17 MR. FLEMING: There's quite a bit --

18 DR. APOSTOLAKIS: Karl doesn't know much about it.

19 MR. FLEMING: There's quite a bit of -- that's,  
20 again -- again, it could have been packaged differently, but  
21 there are a lots of detailed requirements in the systems  
22 analysis section for coverage of common cause events and the  
23 system fault trees and in the data analysis section for  
24 coming up with reasonable data analysis of common cause  
25 parameters.



1           So common cause is addressed, but it didn't reach  
2 the status of -- I remember we had this debate when we were  
3 working on the PRA procedures guide about 25 years ago and  
4 at that time, I won the argument of having a separate  
5 section on dependent events.

6           But over time, I became swayed that this  
7 dependency is so pervasive throughout all the PRA elements  
8 and common cause is a specific subset of those, that we  
9 decided to make it a cross-cutting.

10          As I get into the high level requirements, one  
11 thing you will see is that for just about every element, we  
12 have high level requirements for capturing the dependencies.  
13 There's dependencies across the board and, of course, common  
14 cause --

15          DR. APOSTOLAKIS: We are running out of time, very  
16 rapidly so.

17          DR. WALLIS: Could I say two sentences about  
18 realistic? I think realistic may come back to haunt you.  
19 It's in every one of these boxes. If it's going to be a  
20 standard, there's going to have to be a check-off at some  
21 point. Every one of these says is it realistic, yes or no.  
22 And this is just the place where the critics say PRAs are  
23 not realistic. So realistic is going to be a key debating  
24 point.

25          MR. BERNSEN: I agree. We do have some problems.

1 In trying to explain things, we're trying to use terms for  
2 global concepts, and maybe we need to reconsider whether  
3 this stuff is helpful or not helpful in the standard.

4 In effect, like with the human factors  
5 considerations, when we say realistic, we're looking at  
6 things like consider your feedback, consider reviewing your  
7 procedures, consider a review of your simulator experience  
8 and all these things.

9 This is where the realism is and it's covered in  
10 the supporting requirements. So it's realistic in terms --  
11 you've got to look at the supporting requirements to  
12 understand what we mean by realistic and not use your own  
13 independent judgment of that.

14 So this is a way of kind of globally sweeping up  
15 what's in the supporting requirements and maybe we should  
16 reconsider whether we do that, because it could be  
17 misunderstood.

18 DR. WALLIS: You might consider omitting the word  
19 realistic entirely at this level.

20 DR. SEALE: The problem is that the behavior,  
21 particularly in the human response, is really almost  
22 bimodal. If you have a crew that's well trained and  
23 understands their system and so on, you'll get the kind of  
24 response George was talking about, where the people do  
25 better than you would have attributed to them when they had

1 the problem, but if you were going to put together something  
2 that is a single distribution description of human  
3 performance.

4 On the other hand, if you have people who are not  
5 well trained, you get the tail that you don't want every  
6 time almost, or you're likely to, the people that don't  
7 understand the plant and so on.

8 And the very fact that you have these extremes in  
9 response feeds this debate about what constitutes realistic  
10 of non-realistic performance that the anti's will try to  
11 hang around your neck.

12 So it's a real serious question and I guess maybe  
13 the test is, is it realistic to expect a single maximum  
14 distribution to describe the range of behaviors that you  
15 expect in that category.

16 MR. FLEMING: I'm struggling a little bit with  
17 what to do on this, because this is what the problem is.  
18 The problem is that if I go look at -- if one were to put on  
19 this side of the table the simplified PRAs that maybe  
20 everybody would agree are category one and good quality PRAs  
21 that everybody would agree are two or three, the two most  
22 common characteristics that will distinguish the quality  
23 PRAs from the less than quality PRAs is the deliberate use  
24 of conservative assumptions to simplify the PRA, on the  
25 simplified side, and the lack of completeness and plant

1 fidelity.

2 So what we were trying to do in these tables, and  
3 that's why I'm trying to constructively respond to your  
4 comment, is to get across the notion that we're introducing  
5 the expectation of being realistic only in category two;  
6 i.e., we're permitting the deliberate use of conservative  
7 assumptions in a controlled fashion in category one.

8 And if I take realistic off of there, I'm  
9 struggling with raising the bar too much on the left-hand  
10 side, because I do think there is a role for simplified  
11 conservative assumption-based PRAs for limited applications.

12 DR. APOSTOLAKIS: But somehow you can qualify the  
13 word when you go from two to three and I think the  
14 difference in three is you're more detailed, which means  
15 more realistic. So there is realism and realism.

16 Otherwise, it reads identical and I think --

17 MR. FLEMING: I understand.

18 DR. APOSTOLAKIS: It's a difficult concept to  
19 convey. Can we wrap it up in ten minutes, Karl?

20 MR. FLEMING: Yes.

21 DR. APOSTOLAKIS: Because there may be some  
22 comments from the audience or the staff.

23 MR. FLEMING: In fact, I'm pretty well wrapped up.

24 DR. APOSTOLAKIS: Okay. Good.

25 MR. FLEMING: The last thing I wanted to mention,

1 I'll just throw up one of the examples, this happens to be  
2 from accident sequences.

3 This is an example of what we mean by high level  
4 requirements and we have four or five high level  
5 requirements for each of the nine elements, so we have maybe  
6 40 or 50 high level requirements that pretty well capture,  
7 at a high level, the technical requirements for a quality  
8 PRA.

9 We use this as a yardstick for measuring sort of  
10 the minimum critical mass for any PRA of any application and  
11 in case there is some ambiguity about what's meant by a  
12 particular specific supporting requirement, we use these  
13 high level requirements to provide a better understanding of  
14 what is meant.

15 It also gives the user a little bit of flexibility  
16 in the sense that if he has some new innovative approach to  
17 do common cause failures or whatever, that may not  
18 specifically be mentioned in the detailed tables in the  
19 standard, if he can show that these high level requirements  
20 are met, it provides another way to meet the requirements.

21 When you look at these high level requirements,  
22 you'll see the need to deliver a PRA that provides estimates  
23 of CDF and LERF, a reasonable completeness, and we use the  
24 term reasonable in recognition that we never can be fully  
25 complete and we try to avoid unattainable characteristics,

1 especially in writing a standard that we know that it would  
2 be very, very difficult to show.

3 So we use reasonably complete to mean that a  
4 reasonable set of experts in a peer review team would judge  
5 that the completeness would be adequate.

6 We don't use the term realistic in these tables  
7 because in category one, we may permit conservative  
8 treatment of various issues, but we do require plant  
9 fidelity at this level.

10 You'll see the term plant fidelity, fidelity of  
11 the model, with the plant, appearing in all these high level  
12 requirements that apply and you also see, where it applies,  
13 dependencies. I think probably seven out of the nine  
14 elements have a very strong requirement on adequate  
15 treatment of dependencies, because it comes across again and  
16 again and again.

17 So these high level requirements were in draft  
18 ten, but they were presented in a textual format, and we  
19 thought there was an advantage of bringing these out as a  
20 way to convey the essence of what we were trying to do with  
21 the detailed requirements and try to make it less  
22 prescriptive.

23 So there's a table like this in each one of the  
24 requirements. And then as the detailed technical  
25 requirements are written, they are written against the high

1 level requirements. So each high level requirement has a  
2 multi-page table that repeats the high level requirement at  
3 the top of the page and the top of the columns of those  
4 categories.

5 We remind you that there is a limitation of the  
6 scope of applicability of the requirements to dominant,  
7 risk-significant and more than risk-significant as you go  
8 across the page.

9 And then with those three column headings, that  
10 creates differences across each of the three categories for  
11 every requirement.

12 You'll see that a very large number of these  
13 supporting requirements are the same across all three  
14 categories. There's quite a few examples where there is a  
15 difference between category one and categories two and  
16 three, and there's a few areas where we distinguish across  
17 all three.

18 But the major emphasis of those differentiations  
19 goes back to the original categories that I mentioned.

20 That pretty well concludes the prepared talk that  
21 I had planned to give here today.

22 DR. APOSTOLAKIS: Do the members have any  
23 comments? Graham, you missed the subcommittee meeting, so I  
24 don't know if you have any comments you want to make in  
25 addition to what you've already said.

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1 DR. WALLIS: I had a question in the beginning and  
2 I was trying to formulate it. When this is all being done,  
3 how good do you think PRAs will be? Will they reach what's  
4 needed in order for them to be used with real confidence in  
5 category three?

6 MR. FLEMING: I think my answer to that question,  
7 if I roll back the clock a few years ago before the industry  
8 peer review certification process started and see where we  
9 were at that particular time, we were at a point where the  
10 differences across the PRAs were driven by judgments and  
11 different assumptions made by the PRA teams and it was very  
12 difficult, if not impossible, to see plant-specific  
13 variabilities from plant to plant.

14 Through the industry peer review process, which is  
15 underway right now, I think that is already having a  
16 beneficial effect in bringing together groups organized by  
17 the reactor vendors, where there's a lot more cross-  
18 fertilization from PRA teams participating on different peer  
19 reviews, and the consistency of the PRAs is being improved.

20 The second thing that's impacting the process is  
21 the applications. Many plants have already tried to do  
22 applications of the PRA and I don't know of any example  
23 where, when you try to do an application of a PRA, that you  
24 don't end up improving the PRA in the process.

25 So I think there's already been a movement towards



1 better consistency, but I don't think we're quite there yet  
2 to where we can look at utility A and utility B's PRA  
3 results and the driving differences, the plant to plant  
4 variabilities.

5 DR. WALLIS: The purpose of this is to deal with  
6 the problem. People that don't trust PRAs, because  
7 different people get different answers for the same problem,  
8 and presumably this is trying to fix that problem.

9 MR. FLEMING: I think that the standard will be  
10 value-added when it goes and people actually start using it.  
11 I think the peer review process is already having value-  
12 added and I think --

13 DR. WALLIS: And we'll be able to say no need to  
14 worry, it meets the ASME standard, so it's okay.

15 MR. FLEMING: I think that three things will bring  
16 about the quality that we're looking for. The solid peer  
17 review process, a standard, and exercising these PRAs in  
18 applications, and all three of those will lead us in that  
19 direction.

20 DR. SEALE: It may not be the right word, but in  
21 characterizing the attribute on human performance, perhaps  
22 the word you want is credible rather than realistic.

23 CHAIRMAN POWERS: Let me ask one question about  
24 one of the little codicils that shows up in the  
25 documentation.

1           It comes along and it says, gee, if you find that  
2 your PRA doesn't measure up to one of these requirements,  
3 you can use supplemental analyses to meet the requirement.

4           Yet, there is no requirement articulated for the  
5 supplemental analyses. So I read it as follow the  
6 prescriptions of this standard or do whatever hell you  
7 please.

8           MR. BERNSEN: In the case where the standard will  
9 be used in conjunction, let's say, with the code cases for  
10 in-service inspection and in-service testing, there is a  
11 methodology within those cases that deals with the, if you  
12 will, supplementary judgment, the expert panel and so on  
13 that's required, and something like this will be needed when  
14 the standard is invoked in a specific application.

15           This is not a self-enforcing document. It's a  
16 standard that's there for people to adopt. It's a standard  
17 for the regulator to consider and adopt.

18           CHAIRMAN POWERS: It seems to me that that's fair  
19 enough. So you adopt the standard or not. But what you  
20 don't want people to do is say, ah, I comply with the  
21 standard, and you find out that every single thing he did  
22 was supplemental analyses.

23           It should be okay to say, no, I don't meet that,  
24 but I can satisfy whatever I was trying to do because my  
25 supplemental analyses are good enough, and it should be

1     okay.

2             Right now, with that little codicil in there that  
3     says and you can do anything you want to do, in there  
4     everything complies with that standard.

5             MR. BERNSEN: I think that it would be incumbent  
6     upon the invoker of the standard to identify -- first of  
7     all, if you supplement analysis, you have to document it and  
8     you have to justify it.

9             It would be incumbent on those invoking the  
10    standard to prescribe a review process for that or to look  
11    at it themselves.

12            In other words, as the standard exists now,  
13    without a specific recipe for how one looks at this, that  
14    would be incumbent on those who adopt the standard, who  
15    invoke the standard, who enforce the standard to determine  
16    what method is used for oversight in those cases where it's  
17    supplemented.

18            CHAIRMAN POWERS: I think if you said that, maybe  
19    I'd feel better about it. But I don't think you say that.  
20    I think you give them free reign. The little invocation to  
21    go use some supplemental analyses is a license to kill,  
22    quite frankly.

23            MR. BERNSEN: I guess the problem is that there's  
24    such a large variety of situations that you get into. It's  
25    kind of like the licensees are allowed to do safety

1 evaluations now and how does the staff oversee these.

2 CHAIRMAN POWERS: The difference is they don't  
3 come in and say I comply with the standard in doing these  
4 analyses. They come in and say, well, here are the analyses  
5 I've done. You're going to let them come in and say I  
6 comply with the standard and, in fact, obscure the fact that  
7 everything was done via supplemental analyses or crucial  
8 items.

9 MR. BERNSEN: Perhaps that's one of the things  
10 that needs to be identified in the regulatory acceptance of  
11 this that says you need to submit and identify those  
12 supplementary analyses you've done for this application,  
13 since this is beyond the scope of the standard.

14 The standard just says you have to do it and you  
15 have to document it. The enforcer, if you will, the applier  
16 then needs to decide what method is used to oversee those  
17 supplementary analyses.

18 DR. APOSTOLAKIS: Graham, do you have anything on  
19 success criteria or are you happy? I think we have Jack  
20 Sieber and then Bob Uhrig who have requested the floor.

21 DR. UHRIG: I just had a quick question. Are you  
22 giving any consideration to extending this to the risk meter  
23 concept, the dynamic version of PRA, or is this too far down  
24 the line?

25 MR. BERNSEN: I guess I need to ask Karl when he's

1 going to convene his task group to look into that as one of  
2 the potential future applications, and I have no answer at  
3 this stage.

4 MR. FLEMING: I think that the limitation of the  
5 current standard on annual average risk I think was more of  
6 a resource issue. Configuration of risk management is  
7 something that's extensively being pursued right now and  
8 there's no reason why we can't expand this concept to that  
9 problem.

10 It's a difficult area. I'm not trying to minimize  
11 the difficulty of it. It's much more difficult than annual  
12 average CDF, but the current limitation really was only a  
13 question of the resources that we had to apply to this.

14 DR. UHRIG: The reason I ask is that I hear more  
15 and more people beginning to use these on an operational  
16 basis, make decisions, whether they do a maintenance now or  
17 do it later, this type of thing.

18 MR. FLEMING: Right.

19 DR. APOSTOLAKIS: Any other comments from the  
20 members? NRC staff? Only Mary is here. Mary, would you  
21 have anything to say? I know that the staff is still  
22 reviewing this.

23 MS. DROUIN: We have received the Rev. 12 for  
24 review as part of the public comment period and the staff is  
25 going through and reviewing it. Part of our guidance that

1 we've given to the staff is we did make comments on Rev. 10,  
2 so we will be looking at how well our comments in Rev. 10  
3 were disposed of in Rev. 12, looking at Rev. 12 to see if,  
4 when you go into your decision-making process, one of the  
5 things you want out of a standard is is it able to identify  
6 those weaknesses that would compromise your confidence and  
7 the results that you would have to take into your decision-  
8 making process.

9 So is it getting to that, and I think that was  
10 kind of the thrust of where we came from with our comments  
11 on Rev. 10. Those are well documented. So we'll be looking  
12 to see how well our comments were resolved.

13 DR. APOSTOLAKIS: Okay. Any other comments from  
14 anyone? I think there is one last comment that I want to  
15 make. There was a very interesting comment made by someone  
16 at the workshop and we repeated it at the subcommittee  
17 meeting, but for the benefit of the members.

18 Someone stood up and said, well, gee, shouldn't  
19 the NRC staff itself use this standard for its own -- and  
20 apply it to its own products, in particular, the SPAR  
21 models.

22 CHAIRMAN POWERS: They don't even need to be peer  
23 reviewed, I understand.

24 DR. APOSTOLAKIS: And there was unanimous or near  
25 unanimous agreement at the workshop. When we mentioned it

1 here, I think several members of the staff objected. Not  
2 objected, but they just raised -- in fact, Mike Cheok said  
3 that the SPAR models are even below category one.

4 CHAIRMAN POWERS: We've gotten a letter from the  
5 EDO that says they don't even need to peer review those.

6 DR. APOSTOLAKIS: They don't need to peer review.  
7 That's why I thought it was an interesting comment.

8 CHAIRMAN POWERS: That's what they're used for,  
9 George.

10 DR. APOSTOLAKIS: That's what they're used for.  
11 So this standard then has failed to identify a category  
12 point five and I don't know how you do that in Roman  
13 numerals.

14 MR. BERNSEN: Don't give us added work.

15 DR. APOSTOLAKIS: I'm sorry?

16 MR. BERNSEN: Don't give us added work.

17 DR. APOSTOLAKIS: But I thought it was a very  
18 interesting point, because it gives you a very different  
19 perspective.

20 As I said last time, I have occasions, as an MIT  
21 person, to go and beg for money or present the results of a  
22 study, which brings me down to earth, because if you are  
23 sitting on this side of the table too much, you acquire a  
24 certain attitude. You have to sit on the other side every  
25 now and then.

1 And I think by using this for your own products  
2 will make you look with a different eye.

3 Any other comments from NRC?

4 MS. DROUIN: If I could add something to that.

5 DR. APOSTOLAKIS: Sure.

6 MS. DROUIN: Because I think that if the NRC would  
7 go off and say that they were going to do another 1150,  
8 they're going to try and do a risk assessment on a plant-  
9 specific basis, then I would like to think that we live up  
10 to the standard. I don't think that should be any  
11 different.

12 The SPAR models are not plant-specific models,  
13 these are generic models, very different set of beasts.

14 DR. APOSTOLAKIS: I thought INEL was developing a  
15 SPAR model for every single unit. That's what we were told.

16 MS. DROUIN: They aren't being made to make plant-  
17 specific regulatory decisions.

18 DR. APOSTOLAKIS: Not yet.

19 MS. DROUIN: And I think if they do grow to that,  
20 then my personal opinion is they should live up to the  
21 standard, too. But at this point in time, that's not where  
22 they're at.

23 DR. APOSTOLAKIS: That may very well happen, in  
24 fact.

25 DR. KRESS: The Roman numeral for point five is V



1 over X. Just thought I would let you know that.

2 DR. APOSTOLAKIS: Other examples that were  
3 mentioned were the significant determination processes. Mr.  
4 Markley just reminded me.

5 MR. MARKLEY: The STP grew out of the IPEs,  
6 though.

7 DR. APOSTOLAKIS: Yes. Anyway, the thought was  
8 that the NRC should use them. Any other comments from  
9 anyone?

10 MR. BARTON: I just think they did a heck of a job  
11 from Rev. 10 to Rev. 12.

12 DR. APOSTOLAKIS: And you will have another chance  
13 later today to give me more advice along these lines.

14 MR. BERNSEN: I wanted to again thank you for the  
15 input we have received and the comments. I should point  
16 out, and I think I'm sensitive to this, we have received a  
17 lot of input from staff and also from industry and I  
18 recognize that all of this material we've received have been  
19 recommendations to the project team.

20 And I am sure that, from my perspective, we're not  
21 going to take any of these comments as the final word of any  
22 one of these groups. I wouldn't expect, if we got some  
23 fresh comments, that we would say that these are new curbs  
24 and things of this sort, because people have to evaluate the  
25 standard in terms of the document that's been put out for

1 review. So we understand that.

2 But I just wanted to have you recognize how much support  
3 we've received from staff in the process of doing this and I  
4 think we've received most excellent comments along the way  
5 and they have been very useful.

6 We haven't accepted all of them, but at the same  
7 time, we haven't accepted all the comments from anybody else  
8 either.

9 This is a consensus process, and I'm very  
10 impressed with the amount of support and participation we  
11 receive from everybody.

12 CHAIRMAN POWERS: Similarly, you can't  
13 underestimate how important this activity is to us. Hardly  
14 a meeting goes by that somebody doesn't say "and we really  
15 need a standard in this area." So you're doing a service  
16 for the technical community that is heroic and Herculean at  
17 the same time.

18 You are to be congratulated, because I know that  
19 this is exclusively a voluntary effort.

20 DR. SEALE: And it's hard word.

21 CHAIRMAN POWERS: And hard work and it's a  
22 service.

23 MR. BERNSEN: And it's volunteer work, too.

24 CHAIRMAN POWERS: And it's volunteer work, so my  
25 hat certainly comes off to everybody on the team who works

1 on this, because I know that when you tell me you went from  
2 Rev. 10 to Rev. 11, that was not done with the stroke of a  
3 pen. It was done through the stroke of midnight on several  
4 nights.

5 DR. APOSTOLAKIS: Okay. Back to you.

6 CHAIRMAN POWERS: Thank you, gentlemen. I'm going  
7 to take a ten minute break at this point. We're going to  
8 come back and discuss a little bit what the plan of action  
9 is, and then we're going to discuss what things we're going  
10 to write reports on.

11 [Whereupon, at 3:21 p.m., the meeting was  
12 concluded.]  
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25

REPORTER'S CERTIFICATE

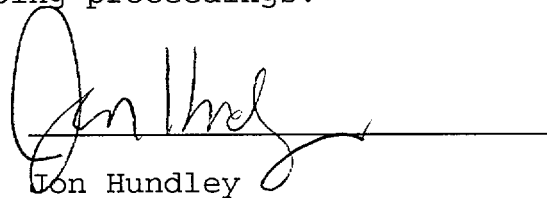
This is to certify that the attached proceedings  
before the United States Nuclear Regulatory Commission in  
the matter of:

NAME OF PROCEEDING: MEETING: 474TH ADVISORY COMMITTEE  
ON REACTOR SAFEGUARDS (ACRS)

CASE NUMBER:

PLACE OF PROCEEDING: Rockville, MD

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

A handwritten signature in dark ink, appearing to read "Jon Hundley", is written over a horizontal line.

Jon Hundley

Official Reporter

Ann Riley & Associates, Ltd.



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, D.C. 20555-0001

June 21, 2000

SCHEDULE AND OUTLINE FOR DISCUSSION  
474<sup>TH</sup> ACRS MEETING  
JULY 12-14, 2000

WEDNESDAY, JULY 12, 2000, CONFERENCE ROOM 2B3, TWO WHITE FLINT NORTH,  
ROCKVILLE, MARYLAND

- 1) 8:30 - 8:35 A.M. Opening Remarks by the ACRS Chairman (Open)
  - 1.1) Opening statement (DAP/JTL/SD)
  - 1.2) Items of current interest (DAP/NFD/SD)
  - 1.3) Priorities for preparation of ACRS reports (DAP/JTL/SD)
  
- 2) 8:35 - 10:30 A.M. Activities Associated with Risk-Informing 10 CFR Part 50 (Open)
  - 2.1) Remarks by the Subcommittee Chairman
  - 2.2) Briefing by and discussions with representatives of the NRC staff and the Nuclear Energy Institute (NEI) regarding:
    - a) Proposed revision to 10 CFR 50.44 concerning combustible gas control system and advance notice of proposed rulemaking (10 CFR 50.69 and Appendix T) (WJS/MTM)
    - b) NEI letter dated January 19, 2000 (TSK/NFD)
  
- 10:30 - 10:45 A.M. **\*\*\*BREAK\*\*\***
  
- 3) 10:45 - 11:45 A.M. Assessment of the Quality of the Probabilistic Risk Assessments (Open) (GA/MTM/MWW)
  - 3.1) Remarks by the Subcommittee Chairman
  - 3.2) Briefing by and discussions with representatives of the NRC staff regarding a draft Commission paper on the assessment of the quality of probabilistic risk assessments (PRAs).

Representatives of the nuclear industry will provide their views, as appropriate.
  
- 11:45 - 1:15 P.M. **\*\*\*LUNCH\*\*\***
  
- 4) 1:15 - 3:15 P.M. Proposed Final ASME Standard for PRA Quality (Open) (GA/MTM)
  - 4.1) Remarks by the Subcommittee Chairman
  - 4.2) Briefing by and discussions with representatives of the American Society of Mechanical Engineers (ASME) regarding the proposed final ASME Standard for PRA quality.

Representatives of the nuclear industry will provide their views, as appropriate.

**3:15 - 3:30 P.M. \*\*\*BREAK\*\*\***

- 5) 3:30 - 4:30 P.M. Break and Preparation of Draft ACRS Reports (Open)  
Cognizant ACRS members will prepare draft reports, as needed, for consideration by the full Committee.
- 6) 4:30 - 7:00 P.M. Discussion of Proposed ACRS Reports (Open)  
Discussion of proposed ACRS reports on:
- 6.1) Proposed Revision to 10 CFR 50.44 concerning combustible gas control system and advance notice of proposed rulemaking (10 CFR 50.69 and Appendix T) (WJS/MTM)
  - 6.2) NEI Letter on Risk-Informing 10 CFR Part 50 (TSK/NFD)
  - 6.3) Assessment of the Quality of PRAs (GA/MTM/MWW)
  - 6.4) Proposed final ASME Standard for PRA Quality (GA/MTM)
  - 6.5) Safety Culture at Nuclear Power Plants (GA/NFD/JS)

**THURSDAY, JULY 13, 2000, CONFERENCE ROOM 2B3, TWO WHITE FLINT NORTH, ROCKVILLE, MARYLAND**

- 7) 8:30 - 8:35 A.M. Opening Remarks by the ACRS Chairman (Open) (DAP/SD)
- 8) 8:35 - 9:30 A.M. Annual Report to the Commission on the NRC Safety Research Program (Open) (DAP/MME)  
Discussion of the format and content of the annual ACRS report to the Commission on the NRC Safety Research Program.
- 9) 9:30 - 9:45 A.M. Reconciliation of ACRS Comments and Recommendations (Open) (DAP, et al./SD, et al.)  
Discussion of the responses from the NRC Executive Director for Operations to comments and recommendations included in recent ACRS reports and letters.
- 10) 9:45 - 10:30 A.M. Future ACRS Activities/Report of the Planning and Procedures Subcommittee (Open) (DAP/JTL/SD)
- 10.1) Discussion of the recommendations of the Planning and Procedures Subcommittee regarding items proposed for consideration by the full Committee during future ACRS meetings.
  - 10.2) Report of the Planning and Procedures Subcommittee on matters related to the conduct of ACRS business, and organizational and personnel matters relating to the ACRS.

**10:30 - 10:45 A.M. \*\*\*BREAK\*\*\***

- 11) 10:45 - 11:45 A.M. Break and Preparation of Draft ACRS Reports (Open)  
Cognizant ACRS members will prepare draft reports, as needed, for consideration by the full Committee.

**11:45 - 12:45 P.M. \*\*\*LUNCH\*\*\***

- 12) 12:45 - 6:00 P.M.      Discussion of Proposed ACRS Reports  
 Discussion of proposed ACRS reports on:
- 12.1) Proposed Revision to 10 CFR 50.44 concerning combustible gas control system and advance notice of proposed rulemaking (10 CFR 50.69 and Appendix T) (WJS/MTM)
  - 12.2) NEI Letter on Risk-Informing 10 CFR Part 50 (TSK/NFD)
  - 12.3) Assessment of the Quality of PRAs (GA/MTM/MWW)
  - 12.4) Proposed final ASME Standard for PRA Quality (GA/MTM)
  - 12.5) Safety Culture at Nuclear Power Plants (GA/NFD/JS)

**FRIDAY, JULY 14, 2000, CONFERENCE ROOM 2B3, TWO WHITE FLINT NORTH, ROCKVILLE, MARYLAND**

- 13) 8:30 - 11:30 A.M.      Discussion of Proposed ACRS Reports (Open)  
 (10:00-10:15 A.M. BREAK) Continue discussion of proposed ACRS reports listed under Item 12.
- 14) 11:30 - 1:30 P.M.      Topics for Meeting with the NRC Commissioners on October 5, 2000  
 Discussion of topics for meeting with the Commissioners scheduled for October 5, 2000.
- 15) 1:30 - 2:00 P.M.      Miscellaneous (Open) (DAP/JTL)  
 Discussion of matters related to the conduct of Committee activities and matters and specific issues that were not completed during previous meetings, as time and availability of information permit.

**NOTE:**

- Presentation time should not exceed 50 percent of the total time allocated for a specific item. The remaining 50 percent of the time is reserved for discussion.
- Number of copies of the presentation materials to be provided to the ACRS - 35.

# **Risk-Informed Part 50 Option 2**

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Presentation for the ACRS  
July 12, 2000

*Mohammed A. Shuaibi & Michael C. Cheok*  
*Division of Systems Safety and Analysis*  
*Joseph F. Williams*  
*Division of Licensing Project Management*  
*Office of Nuclear Reactor Regulation*



# Agenda

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- ANPR comments
- Preliminary staff views on industry guideline and PRA peer certification process
- Status/Schedule

# **ANPR Comments**

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## **Approach**

- General agreement on the list of rules identified, with a proposal to risk-inform them in a phased approach
- Be performance-based, optional, and allow for selective implementation
- Limited NRC prior review and approval
- Backfit rule should be applied to Option 2

# **ANPR Comments - continued**

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## **Categorization - Appendix T**

- Unduly detailed, prescriptive, and burdensome
- Should not identify the consensus PRA standards as only acceptable method
- Should minimize levels of risk significance
- Allow for functional categorization
- Address the use of results from PRAs or tools with different levels of conservatism and uncertainty

# **ANPR Comments - continued**

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## **Treatment**

- Additional treatment for safety significant attributes should be determined by licensees and should rely on existing licensee programs
- Commercial programs provide sufficient treatment for LSS SSCs
- Rulemaking should eliminate existing commitments for LSS SSCs
- Risk-informed change process should be included in new rule

# **ANPR Comments - continued**

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## **Pilot Program**

- Final rule should not be backfit on pilot plants with reviewed and accepted processes
- STP has demonstrated the risk-informed process for many different types of systems and components; no need to include strict requirements for other pilot plants to do so

# **Industry Implementation Guidance Documents for Option 2**

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## **Background**

- Categorization guidance (draft) provided on March 29, 2000
- NEI 00-02 submitted on April 24, 2000
- Treatment guidance (draft) submitted on June 7, 2000

# **PRA Peer Certification**

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## **NRC Review of NEI 00-02**

- Process review
- Technical elements and requirements
- Option 2 categorization requirements
  - ▶ Appendix T and NEI categorization guidance review
  - ▶ Assess “Grade 3” for application to Option 2
  - ▶ Define “trade-offs,” and compensatory measures
- Documentation and review requirements

# **PRA Peer Certification**

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## **NEI 00-02 Topics**

- NRC will review subtier criteria
- Integration of peer review results into categorization process
- Applicability of previous peer reviews
- Independent decisionmaking panel



# **Categorization & Treatment Guideline**

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## **Categorization**

- PRA Scope and Quality
- Role of importance analysis
- Role of the integrated decision-making panel
- Role of monitoring and feedback

# **Categorization & Treatment Guideline - continued**

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## **Treatment**

- Definition of “commercial practices”
- Preservation of design basis
- Change control
- Adequate assurance of RISC-2 capability
- Adequate assurance of RISC-3 functionality

# **Categorization & Treatment Guideline - continued**

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## **Treatment - continued**

- Staff is developing guidance for review of the STP exemption
- Staff to develop Option 2 treatment acceptance criteria
- Consistency between STP and NEI proposals

# **Status/Schedule**

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## **RIP50, Option 2**

- August 2000 - ANPR comments & issues paper
- September 2000 - Commission briefing
- Fall 2000 - pilot program
- December 2000 - final acceptance criteria
- August 2001 - proposed rulemaking to Commission
- December 2002 - final rulemaking to Commission

# **Risk-Informed, Performance- Based Regulation**

**NRC Advisory Committee on  
Reactor Safeguards**

**July 12, 2000**

**Adrian Heymer, NEI**

**(202)-739-8094**



# **Option 2**

- **Guideline still evolving**
- **PRA Quality & Completeness**
- **Detailed regulatory appendix**
- **Prior review and approval**
- **Selective & Voluntary**
- **Correlation with STP exemption request**
  - Processes are essentially similar
- **Commercial programs**

# Proposed Revision to Risk-Informed SSC Categories

	Safety-Related	Nonsafety-Related
Safety Significant	<p><b><i>RISC-1</i></b></p> <p><i>As per existing requirements</i></p>	<p><b><i>RISC-2</i></b></p> <p><i>No change in treatment requirements. Performance-Based Reporting Requirements Subject to Monitoring Program &amp; Existing (Commercial &amp; Augment Quality) Programs*</i></p>
Not Categorized as Safety Significant	<p><b><i>RISC-3</i></b></p> <p>Directly referenced in specific regulations</p> <p><i>Maintain functions required by specific regulations Supersession of Commitments (Commercial Programs*)</i></p>	<p><b><i>RISC-4</i></b></p> <p><b>Not in Regulatory Scope</b></p> <p>(Commercial Programs*)</p>

\*Commercial programs are sometimes known as BOP programs

DRAFT



# Option 2 Issues

- **Legal issues?**
- **Commercial treatment for RISC-3**
  - Preservation of design function
  - Level of detail for regulatory control
- **Treatment of prior commitments for RISC-3 SSCs**
  - Rulemaking alone will not explicitly address
  - Industry commitment management guidelines



# **Option 3 NRC Framework**

- **Thoughtful effort by NRC staff and contractors to quantify all elements of regulatory structure**
- **June 30 NRC-NEI meeting clarified some issues**
  - Interim status of NRC Framework document
- **Previously dispositioned technical issues being reintroduced -- bases?**

# **Option 3 - Preferred approach**

- **Pragmatic versus theoretical**
- **Use generic risk insights to improve current requirements**
  - Example: design basis accident assumptions
- **Preserve existing risk-informed philosophy**
  - Integrated consideration of risk insights, traditional engineering approaches, safety margin

# **Option 3 - Industry Priorities**

- **Complete ongoing efforts**
  - Hydrogen control (§50.44)
  - Fire protection (§50.48, Appendix R)
- **Focus on areas of greatest potential benefit**
  - Large Break LOCA (§50.46)
- **Develop schedule for other regulatory improvements based on demonstrated success with §50.46**

# Observations

- **RES and NRR approaches appear to be different**
  - Theoretical (risk-based) vs pragmatic (risk-informed)
- **NRC discussions on Option 2 continue to focus on low safety-significant functions, rather than those of high safety significance**
- **Licensees have moved beyond IPEs**
  - Licensee PRA studies & summaries

# Observations

- **A successful conclusion of 10 CFR 50.44 rulemaking (Option 3) & STP exemption request (Option 2) will increase confidence in risk-informed regulation**

Advisory Committee on Reactor Safeguards  
Full Committee

Petition for Rulemaking  
Combustible Gas Control

July 12, 2000  
Two White Flint, Rockville, MD

Bob Christie

Performance Technology  
P. O. Box 51663  
Knoxville, TN 37950-1663  
(865) 588-1444  
FAX (865) 584-3043  
[performtech@compuserve.com](mailto:performtech@compuserve.com)

# Agenda

A. Key Points

B. Petition for Rulemaking

1. 10CFR50, Appendix A, GDC 41
2. 10CFR50.44

C. Summary

## Key Points - Combustible Gas Control

### Public Health Risk

Severe Accidents - Not Design Basis Accidents.

Containment integrity when fission products present.

Existing hydrogen recombiners and purge ineffective.

Existing hydrogen procedures can distract operators.

Activation of hydrogen purge systems and portable hydrogen recombiners during severe accidents can be detrimental to public health and safety.



10CFR50, Appendix A  
Criterion 41- Containment Atmosphere Cleanup

Existing

Systems to control fission products, hydrogen, oxygen, and other substances which may be released into the reactor containment shall be provided ~~as necessary to reduce~~, consistent with the functioning of other associated systems, ~~the concentration and quality of fission products released to the environment following postulated accidents, and to control the concentration of hydrogen or oxygen and other substances in the containment atmosphere following postulated accidents~~ to assure that containment integrity is maintained.

My proposed revised 10CFR50, Appendix A, General Design Criteria 41, Containment atmosphere cleanup, is as follows:.

As necessary, systems to control fission products, hydrogen, oxygen, and other substances which may be released into the reactor containment shall be provided, consistent with the functioning of other associated systems, to assure that reactor containment integrity is maintained for accidents where there is a high probability that fission products may be present in the reactor containment.

My proposed revised 10CFR50.44, Standards for combustible gas control system in light-water-cooled power reactors, is as follows:

- a.) An inerted reactor containment atmosphere shall be provided for each boiling light-water nuclear power reactor with a Mark I or Mark II type containment.
- b.) Each licensee with a boiling light-water nuclear power reactor with a Mark III type of containment and each licensee with an ice condenser type of containment shall provide its nuclear power reactor containment with a hydrogen control system. The hydrogen control system must be capable of handling (based on realistic calculations) the hydrogen equivalent to that generated from a metal-water reaction involving 75% of the fuel cladding surrounding the active fuel region (excluding the cladding surrounding the plenum volume).

My proposed revised 10CFR50.44, Standards for combustible gas control system in light-water-cooled power reactors, is as follows:

- c.) All light water reactors with other types of containment than in (a) or (b), must demonstrate that the reactor containment (based on realistic calculations) can withstand, without any hydrogen control system, a hydrogen burn for accidents with a high probability of causing severe reactor core damage. If such an evaluation of reactor containment capability can not be demonstrated, then the licensee shall provide a hydrogen control system per the backfit process. This hydrogen control system must be capable of handling (based on realistic calculations) the hydrogen equivalent to that generated from a metal-water reaction involving 75% of the fuel cladding surrounding the active fuel region (excluding the cladding surrounding the plenum volume)

My proposed revised 10CFR50.44, Standards for combustible gas control system in light-water-cooled power reactors, is as follows:

- d.) Each light-water nuclear power reactor shall be provided with high point vents for the reactor coolant system, for the reactor vessel head, and for other systems required to maintain adequate reactor core cooling if the generation of noncondensable gases in these systems would realistically lead to severe reactor core damage during an accident. High point vents are not required, however, for the tubes in U-tube steam generators.

# SUMMARY

Sufficient knowledge exists to change the regulations for Combustible Gas Control.

Focus must be on severe accidents.

Petition for rulemaking is a combination of:

- Retain what is effective and efficient.

- Add where necessary.

- Delete what is not effective and efficient.

Implementation of the petition will be "risk positive."

Petition for rulemaking meets the requirements of 10CFR50.109, Backfitting.

Note: Rulemaking is a result of a letter I sent to the NRC Commissioners on October 7, 1999. The letter was changed to a petition for rulemaking with my agreement. Implementation does not depend on "Option 3."

ACRS Meeting on Rev 12  
of the ASME PRA Standard  
July 12, 2000

# **INTRODUCTION & GENERAL REVIEW**

**Sid Bernsen**  
**Chair, ASME Committee on Nuclear Risk Management**



# ROLE OF PARTICIPANTS

- individual experts
- comments do not necessarily represent position of CNRM or ASME
- seeking feedback and recommendations
- position still on several issues still needs definition
- **We welcome your interest and input**





# SCOPE AND PURPOSE

- Level 1 PRA analysis of internal events
  - at power - excluding fires
- Limited Level 2 - Sufficient for LERF evaluation
- Developed to support
  - risk informed applications
  - use of existing PRAs
- Process for determining PRA ability to support an application and provides options for augmentation



# DEVELOPMENT PROCESS

- Use ASME redesign process
- Project Team for development
- early opportunity for review & comment
- approval by balanced committee of stakeholders - CNRM
- oversight by ASME Board on Nuclear Codes & Standards
- recognition by ANSI



# CURRENT STATUS

- draft 10 issued spring 99
  - more than 2000 general and specific comments received
  - project team worked *intensively* to address comments
  - draft 12 issued for comment May 30 2000
    - includes a white paper
    - conducted workshop June 27
    - review with ACRS subcommittee June 28
- 



# PROJECTED SCHEDULE

- August 14, 2000 comment period ends
- Project Team dispositions comments
- October 2000 to CNRM committee for approval
  - includes responses to substantive comments
  - initiate formal public review
- November, 2000 receive votes and comments
- Project team resolves comments
  - changes to committee for review and reconsideration
- Early 2001 BNCS final review and approval



# PURPOSE OF CURRENT REVIEW

- resolution of your specific comments on Draft 10.
- acceptability of other changes
- recommendations for future consideration
- comments should be supported with basis/justification
- include proposed word changes, additions or deletions



# AGENDA

- general comments received on Rev 10
- major changes from rev 10 to rev 12
- risk assessment application process
- approach used to develop PRA technical requirements
- peer review
- summary of selected questions and comments from workshop and ACRS SC meetings
- general discussion



# **Major changes from the previous draft in response to public comments**



## Rev 10 comments

- Prescriptiveness and perceived difficulty in applying the process
- need to distinguish among grades of application with a commensurate level of PRA capability
- need to recognize primary use of standard will be with existing PRAs
- need for closer alignment with the industry peer review and certification process





## **Rev 12 approach**

- **Significant restructuring, e.g.,**
  - process moved from back to front to emphasize intended use of the standard
  - mandatory appendix with generic data base removed
- **Range of possible risk informed applications approximated by three Categories**
- **Corresponding PRA capabilities presented in tables with three columns**
  - action statements whose scope of applicability varies across the three columns



## **Rev 12 approach (cont.)**

- PRA Element requirements linked to industry certification process criteria, where possible
- peer review requirements reference the industry certification process methodology
- retention of Rev 10 requirements, where appropriate
- modification of the application process to make it easier to use



## **The application process**

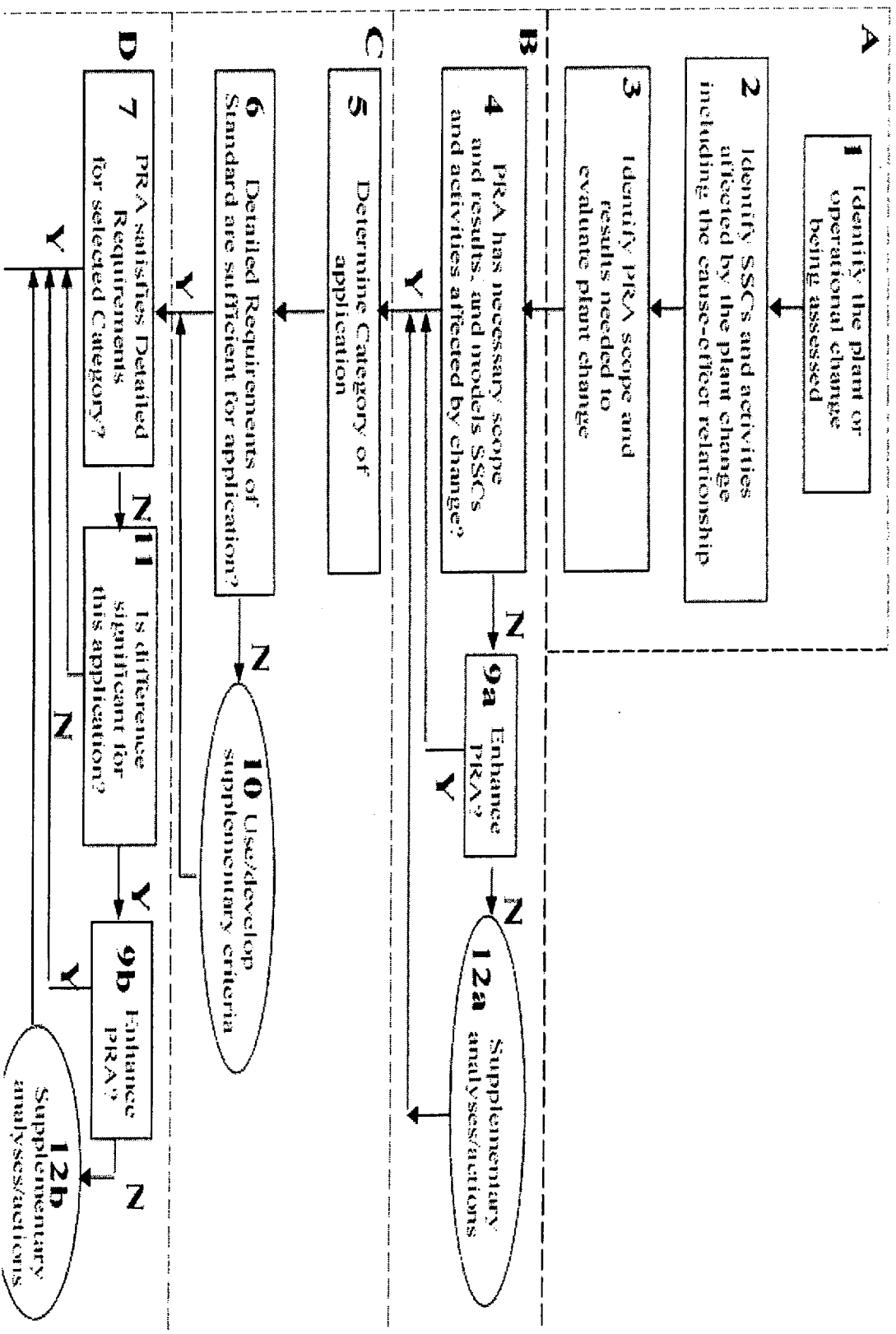
- **Requirements in Section 4 of the standard apply only to a PRA to be used with this process**
- **The process is intended to be used with PRAs that have had a peer review that meets the requirements of Section 6 of the standard**
- **PRA capabilities are evaluated for each Supporting Requirement in Section 4, *vice* specifying a capability level for the entire PRA**
- **Only those aspects of a PRA Element required to support the application in question need the capability level appropriate for that application**



## The application process (cont.)

- Define the application in terms of SSCs affected by the proposed change
- Determine if the scope and level of detail of the plant PRA is sufficient for the application (if not, enhance or supplement PRA)
- Determine the Category of the application and whether the level of detail in the standard is sufficient for the application (if not, use supplementary criteria)
- Compare the PRA to the appropriate requirements in the standard to determine whether the PRA has adequate capability to support the application
- If difference is significant, enhance or supplement PRA





# Peer Review



# **FEEDBACK FROM WORKSHOP AND ACRS SUBCOMMITTEE MEETINGS**

- **Text of Draft 12 needs to be more consistent with presentations and associated slides**
- **Positive feedback on introduction of High Level Requirements and Applications Categories; use with specific applications needs some clarification**
- **Need definitions of “Risk Significant” and “Dominant”**
- **Relationship between RG 1.174 risk significance criteria and applications categories needs more emphasis**
- **Need to clear up some inconsistencies in SR’s with regard to treatment of point estimates, mean values, and uncertainty quantification**
- **Flexibility in LERF definition not consistent with current scope of the standard**



# **FEEDBACK FROM WORKSHOP AND ACRS SUBCOMMITTEE MEETINGS**

- consider publishing a set of FAQs
- clarify “use of standard with existing PRAs”
- why not publish comments and response?
- why not have uncertainty as separate element?
- standard should not prescribe relationship of categories to regulatory applications - consider referencing RG 1.174 for categorization requirements
- clarify when an additional peer review is required
- define lower limits of category III





# FEEDBACK FROM WORKSHOP AND ACRS SUBCOMMITTEE MEETINGS

(cont.)

- concern with misuse of lower category PRA elements
- review conflict of interest requirements for peer reviewers
  - may need improved definition to be consistent with NRC definitions
- some definitions need clarification others should be added  
(examples: *realistic*, *dominant*, *risk significant*, *unavailability*)
- application process depicted in flowchart needs more flexibility
- consider a matrix for the flowchart relating attribute to category
- review extent of flexibility permitted for alternate peer review methodology
- appropriateness of referencing NEI-00-02



ACRS Committee meeting on  
Rev 12 of the ASME standard  
July 12, 2000

## **Developing Technical Requirements for a Range of Applications (Section 4)**

Karl Fleming  
Member, ASME Project Team and CNRM



# Draft 12 Technical Requirements

- Technical requirements from Draft 10 retained
- Additional input developed from Industry PRA Certification Peer Reviews
- Public comments on Draft 10 addressed by restructuring the presentation of requirements
  - Objectives defined for each PRA element
  - High Level Requirements introduced to define the minimum requirements in a top down fashion; expressed in “shall do” language
  - PRA attributes needed to supported applications defined for each PRA element to define scope of requirements
  - Supporting Requirements developed for three broad PRA application categories to acknowledge the link between PRA quality expectations and applications; expressed as action statements
  - Improved consistency between technical requirements and documentation requirements for each element



# Application Categories

- The standard is intended to be used in a wide range of applications
- Three broad Categories were used to develop and present the requirements of Section 4
- The plant PRA capabilities across all elements will generally not fall into a particular Category
- For some applications, the plant PRA for a given element or elements may not have to meet specific requirements



# CHARACTERISTICS OF CATEGORIES

CATEGORY I	CATEGORY II	CATEGORY III
<b>1. Reliance of the risk informed decision on the PRA , i.e., decisions are based ...</b>		
... primarily on deterministic analysis supplemented with risk insights	... on a balanced set of PRA insights and deterministic analyses	... primarily on PRA insights supplemented with little deterministic analysis
<b>2. Required level of resolution of the PRA results needed by the application, i.e., PRA results are used ...</b>		
... to differentiate among broad categories of safety significance using order of magnitude CDF and LERF estimates	...to prioritize/risk rank SSCs and to resolve risk contributors for risk significance determinations	... as in Category II and to achieve confidence in results when decision/ risk acceptance criteria are approached
<b>3. Degree of accuracy required of the PRA results ...</b>		
Order of magnitude estimates of PRA results for all risk significant sequences and contributors	Realistic estimates of PRA results for all risk significant sequences and contributors	Realistic (better than order of magnitude) estimates of PRA results for sequences and contributors
<b>4. Degree of confidence in the PRA results ...</b>		
Only a general understanding of the sources and magnitudes of uncertainties and their impacts	Detailed understanding of the sources and magnitudes of the uncertainties and their impact on all risk significant sequences and risk contributors	Same as Category II with uncertainty quantification for CDF and LERF
<b>5. Safety significance of the application, e.g., impact safety related SSCs?</b>		
Typically, no	Yes	Yes



# Scope of Coverage of Technical Requirements

- Category I Requirements apply to
  - Dominant accident sequences and contributors
  - Definition of dominant is to capture major fraction of baseline risk that is sufficient to support intended applications
- Category II Requirements apply to
  - Risk Significant accident sequences and contributors
  - Definition of risk significant is to capture sufficient fraction of baseline risk to support risk significant determinations in risk informed applications under RG 1.174
- Category III Requirements apply to
  - Risk Significant accident sequences and contributors as well as non-risk significant sequences and contributors that are relevant to a Category III application
  - Coverage of sequences and contributors is sufficient to support risk informed applications under RG 1.174 in which risk acceptance criteria are approached requiring additional NRC management review



# ATTRIBUTES FOR PRA ELEMENTS

ELEMENT		CATEGORY I	CATEGORY II	CATEGORY III
Initiating Events Analysis	IE	Identification and quantification of dominant accident initiating events	Identification and realistic quantification of risk significant accident initiating events	Identification and realistic quantification of initiating events
Accident Sequence Analysis	AS	Modeling of dominant core damage and large early release accident sequences	Modeling of risk significant core damage and large early release accident sequences	Modeling of core damage and large early release accident sequences
Success Criteria	SC	Bases and supporting analyses for establishing success or failure in dominant accident sequences	Realistic bases and supporting analyses for establishing success or failure in risk significant accident sequences	Realistic bases and supporting analyses for establishing success or failure for modeled accident sequences
Systems Analysis	SY	Modeling of key components and failure modes contributing to the function of systems expected to operate in dominant accident sequences	Realistic modeling of major components and failure modes contributing to the reliability and availability of systems expected to operate in risk significant sequences	Realistic modeling of components and failure modes contributing to the reliability and availability of systems expected to operate in modeled sequences



# ATTRIBUTES (Cont'd)

ELEMENT		CATEGORY I	CATEGORY II	CATEGORY III
Human Reliability Analysis	HR	Modeling of major human actions (i.e., latent, response and recovery) with screening Human Error Probabilities (HEPs)	Realistic modeling of human actions (i.e., latent, response and recovery) with plant-specific HEPs in risk significant sequences	Realistic modeling of human actions (i.e., latent, response and recovery) with plant-specific HEPs
Data Analysis	DA	Quantification of point estimates for basic events, and associated parameters with generic data for dominant accident sequences	Realistic quantification of mean values for basic events, and associated parameters in a manner that accounts for relevant plant specific and generic data for risk significant sequences	Realistic quantification of risk significant basic events in a manner that quantifies impacts of uncertainties
Internal Flooding	IF	Modeling of dominant flood sequences and contributors	Realistic modeling of risk significant flood sequences and contributors	Realistic and thorough modeling of flooding sequences and contributors
Quantification	QU	Quantification of CDF and key contributors supported by an understanding of the impact of key uncertainties	Realistic quantification of CDF and key contributors supported by a sound understanding of the impact of uncertainties	Realistic quantification of CDF and risk significant contributors supported by a sound understanding and quantification of the impact of uncertainties
Level 2 Analysis	L2	Quantification of LERF with an understanding of the impact of key uncertainties for the dominant LERF contributors	Realistic quantification of LERF with a sound understanding of the impact of uncertainties for risk significant accident sequences.	Realistic quantification of LERF supported by a sound understanding and quantification of the impact of uncertainties





## Section 4 requirements

- High Level Requirements (HLRs) capture the important technical issues that are needed for any meaningful PRA application
- HLRs apply to PRAs in all three application categories
- Supporting Requirements (SRs) are phrased as action statements that support the HLRs
- SR's may or may not differentiate across the application categories
- When an action statement extends to more than one Category, its scope of applicability varies as appropriate for applications in that Category



Table 4.4.2 HIGH LEVEL REQUIREMENTS FOR ACCIDENT SEQUENCE ANALYSIS (HLR-AS)

- A **Functional Sequence Categories** The *Accident Sequence Analysis* shall provide a reasonably complete set of scenarios that can lead to core damage following each initiating event or initiating event category defined in *Initiating Events Analysis*. These scenarios shall cover system responses and operator actions, including recovery actions, that support the key safety functions<sup>(2)</sup> necessary to prevent core damage, and shall be defined in a manner that supports the Level 1/Level 2 interface. (HLR-AS-A)
- B **Plant Specific CDF and LERF Quantification** The *Accident Sequence Analysis* shall provide a sequence definition structure that is capable of supporting plant specific quantification of the CDF, and LERF via the Level 1/Level 2 interface. (HLR-AS-B)
- C **Interface with Success Criteria** *Accident Sequence Analysis* shall provide an interface with the success criteria, mission times, and time windows needed to support each key safety function<sup>(2)</sup> represented in the modeled scenarios. (HLR-AS-C)
- D **Treatment Of Dependencies** Dependencies due to initiating events, human interface, functional dependencies, environmental and spatial impacts, and common cause failures shall be addressed. (HLR-AS-D)
- E **Documentation** The *Accident Sequence Analysis* shall be documented in a manner that facilitates PRA applications, updates, and peer review by describing the processes that were followed, with assumptions and bases stated. (HLR-AS-E)

<sup>(2)</sup> Key safety functions are the minimum set of safety functions that must be maintained to prevent core damage and large early release. These include, at a minimum, reactivity control, core heat removal, reactor coolant inventory control, reactor coolant heat removal, and containment bypass integrity in appropriate combinations to prevent core damage and large early release.



**TABLE 4.4-2a SUPPORTING REQUIREMENTS FOR ACCIDENT SEQUENCE ANALYSIS HIGH LEVEL REQUIREMENT A**  
**FUNCTIONAL SEQUENCE CATEGORIES:** The *Accident Sequence Analysis* shall provide a reasonably complete set of scenarios that can lead to core damage following each initiating event or initiating event category defined in *Initiating Events Analysis*. These scenarios shall cover system responses and operator actions, including recovery actions, that support the key safety functions<sup>(2)</sup> necessary to prevent core damage, and shall be defined in a manner that supports the Level 1/Level 2 interface. (HLR-AS-A)

Index No. AS	CATEGORY I APPLICATIONS Modeling of dominant core damage and large early release accident sequences	CATEGORY II APPLICATIONS Modeling of risk significant core damage and large early release accident sequences	CATEGORY III APPLICATIONS Modeling of core damage and large early release accident sequences
AS-A1 [AS-6] [3.3.2.2]	CHOOSE a method for <i>Accident Sequence Analysis</i> that explicitly models the appropriate combinations of system responses and operator actions that affect the key plant safety functions for each modeled initiating event. DEFINE and INCLUDE the critical safety functions that are assumed to be necessary to reach a safe stable state in the model.		
AS-A2 [AS-4] [3.3.2.2]	USE a method for <i>Accident Sequence Analysis</i> that : a) includes a reasonably complete set of event sequences involving core damage that could result from each modeled initiating event. b) considers the different plant responses and containment challenges that could result from each modeled initiating event; and c) provides a framework to support sequence quantification. d) reflects the initiating event categories defined in the <i>Initiating Events Analysis</i>	USE a method for <i>Accident Sequence Analysis</i> that : a) includes a reasonably complete set of event sequences involving core damage that could result from each modeled initiating event. b) models the different plant responses and addresses the containment challenges that could result from each modeled initiating event; and c) provides a framework to support sequence quantification. d) is explicitly traceable to the initiating event categories defined in the <i>Initiating Events Analysis</i>	
AS-A3 [AS-4]	DEFINE separate accident sequences as needed to address differences in timing, system success criteria, and operator actions.		
AS-A4 [AS-8]	ADDRESS a level of discrimination in the event tree structure that represents the key procedurally directed operator actions and delineates the differences in success criteria reflected in challenges to the critical safety functions.	DEVELOP a level of discrimination in the event tree structure that represents the key procedurally directed operator actions and delineates the differences in success criteria reflected in challenges to the critical safety functions.	
AS-A5 [AS-4] [3.3.2.2]	USE event trees or their equivalent to represent the accident sequence logic. JUSTIFY the use of alternatives to event trees (e.g., single top fault tree).		

(2) Key safety functions are the minimum set of safety functions that must be maintained to prevent core damage and large early release. These include, at a minimum, reactivity control, core heat removal, reactor coolant inventory control, reactor coolant heat removal, and containment bypass integrity in appropriate combinations to prevent core damage and large early release.



**TABLE 4.4-2a SUPPORTING REQUIREMENTS FOR ACCIDENT SEQUENCE ANALYSIS HIGH LEVEL REQUIREMENT A**  
**FUNCTIONAL SEQUENCE CATEGORIES:** The *Accident Sequence Analysis* shall provide a reasonably complete set of scenarios that can lead to core damage following each initiating event or initiating event category defined in *Initiating Events Analysis*. These scenarios shall cover system responses and operator actions, including recovery actions, that support the key safety functions<sup>(2)</sup> necessary to prevent core damage, and shall be defined in a manner that supports the Level 1/Level 2 interface. (HLR-AS-A)

Index No. AS	CATEGORY I APPLICATIONS Modeling of dominant core damage and large early release accident sequences	CATEGORY II APPLICATIONS Modeling of risk significant core damage and large early release accident sequences	CATEGORY III APPLICATIONS Modeling of core damage and large early release accident sequences
AS-A6 [AS-4] [3.3.2.2]	USE an acceptable event tree/fault tree method for interfacing the Accident Sequence Analysis with the Systems Analysis tasks. Acceptable approaches for event tree/fault tree modeling include. event trees with conditional split fractions(also referred to as event tree linking), and fault tree linking, both described in (Reference [4.4.2-1]). JUSTIFY the use of alternative approaches for this function.		
AS-A7 [3.3.2.4.1]	DEVELOP the event trees in sufficient detail to: a) determine which safety systems, functions, and operator actions have been challenged for each accident sequence b) determine whether core damage has occurred or core damage may be assumed initially in the PRA development c) identify the conditions needed to define the appropriate operator recovery actions and the necessary conditions for each sequence.		
AS-A8 [AS-4]	INCLUDE each necessary critical safety function in the quantitative model. JUSTIFY exceptions to the critical safety functions that are omitted from the model.		
AS-A9 [AS-7]	INCLUDE those relevant systems that support each critical safety function in the event sequence model in support of sequence quantification.		
AS-A10 [AS-8]	Transfers between event trees MAY be used to reduce the size and complexity of individual event trees. DEFINE any transfers that are used and the method that is used to implement them in the qualitative definition of accident sequences and in their quantification. USE a method for implementing an event tree transfer that preserves the dependencies that are part of the transferred sequence. These include functional, system, initiating event, operator, and spatial or environmental dependencies.		
AS-A11 [AS-8]	When event tree branching and event tree transfers are employed, DEVELOP the structure in a manner that maintains and unambiguously resolves the definition of success and failure paths.		
AS-A12 [3.3.2.4]	CONSIDER USING one or more accepted methods for developing and documenting the event sequence modeling process. Accepted methods include: a) functional and systemic event trees or both (as explained in Reference [4.4.2-1]) b) event sequence diagrams c) system dependency matrices	USE one or more accepted methods for developing and documenting the event sequence modeling process. Accepted methods include: a) functional and systemic event trees or both (as explained in Reference [4.4.2-1]) b) event sequence diagrams c) system dependency matrices	
AS-A13 [3.3.2.4]	INCLUDE a traceable interface between the event tree development process and the method or methods chosen from above or JUSTIFY use of alternative methods	INCLUDE a traceable interface between the event tree development process and the method or methods chosen from above.	



# The Category of a given application depends on ...

1. Extent of the reliance of the risk informed decision on the PRA

Decisions are based ...

- Category I: ...primarily on deterministic analysis supplemented with risk insights
- Category II: ...on a balanced set of PRA insights and deterministic analyses
- Category III: ... primarily on PRA insights supplemented with little deterministic analyses



# The Category of a given application depends on ...

## 2. Required level of resolution of the PRA results needed by applications

- Category I: PRA products are used to differentiate among broad categories of safety significance using order of magnitude CDF and LERF estimates
- Category II: PRA products are used to prioritize/risk rank SSCs and to resolve risk contributors for risk significance determinations
- Category III: PRA products are used to prioritize/risk rank SSCs; to resolve risk contributions for risk significance determinations; and to achieve confidence in results when decision/risk acceptance criteria are approached



# The Category of a given application depends on ...

## 3. Degree of accuracy and realism required of the PRA results

- Category I: Order of magnitude estimates of the PRA results for dominant sequences and contributors
- Category II: Realistic estimates of PRA results for all risk significant sequences and contributors
- Category III: Realistic (better than order of magnitude) estimates of PRA results for sequences and contributors



# The Category of a given application depends on ...

## 4. Degree of confidence in the PRA results

- Category I: Only a general understanding of the sources and magnitudes of uncertainties and their impacts
- Category II: Detailed understanding of the sources and magnitudes of the uncertainties and their impact on all risk significant sequences and risk contributors
- Category III: Same as Category II with uncertainty quantification for CDF and LERF





# The Category of a given application depends on ...

## 5. Safety significance of the application

- Category I: Typically do not impact safety related SSCs
- Category II: Expected to impact safety related SSCs
- Category III: Expected to impact safety related SSCs





*United States*  
*Nuclear Regulatory Commission*

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# Risk-Informed Part 50 Framework and Risk-Informed 50.44

Presented to

Advisory Committee on Reactor Safeguards

July 12, 2000

# OUTLINE

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- Framework For Risk-Informing 10CFR Part 50
- Risk-informed 50.44
- Schedule

# FRAMEWORK

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- ▶ Framework applied to regulations, regulatory guides, DBAs, to screen and formulate technical requirements
- ▶ Framework is a risk-informed Defense-in-depth approach
- ▶ Framework based upon prevention and mitigation strategies to protect public (derived from Reactor Safety Cornerstones)
- ▶ Framework includes various tactics to implement prevention and mitigation
- ▶ Framework requires consideration of both design basis and severe accidents

# DEFENSE-IN-DEPTH STRATEGIES

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- ▶ Prevent core damage
  - Limit frequency of accident initiating events
  - Limit the probability of core damage given event
  
- ▶ Mitigate core damage
  - Limit radionuclide releases given core damage (containment)
  - Limit public health effects given release (emergency planning)

# DEFENSE-IN-DEPTH TACTICS

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- ▶ Tactics not dependent on risk insights:
  - use of good engineering practices (e.g., codes and standards, negative power coefficient, etc.)
  - maintain same level of protection against AOOs
  - three barriers to radionuclide release
  - emergency planning
  
- ▶ Tactics dependent on risk insights:
  - balance between prevention and mitigation
  - level of redundancy/diversity/independence necessary to achieve balance
  - guidelines for consideration of passive component failures
  - temporary conditions

# QUANTITATIVE GUIDELINES

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- ▶ Quantitative guidelines used to help establish, screen and formulate regulation and technical requirements
- ▶ Guidelines for staff use, ***will not appear in regulation*** (although may appear in regulatory guide)
- ▶ Guidelines derived from Commission Safety Goals (Quantitative Health Objectives)
  - Safety goals define “how safe is safe enough”
  - Risk-informing regulations should not impose requirements that force risk from plants to go beyond these guidelines
- ▶ No quantitative definition of “adequate protection”

# QUANTITATIVE GUIDELINES

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- ▶ Based on full-scope PRAs
- ▶ Guidelines:
  - Core damage frequency  $< 1\text{E-}4/\text{yr}$
  - Conditional early containment failure probability  $< 0.1$
  - Large early release frequency (LERF)  $< 1\text{E-}5/\text{yr}$   
(surrogate for early health effect guideline)
  - Conditional probability of large late release  $< 0.1$
- ▶ CDF and LERF guidelines consistent with RG 1.174
- ▶ Initiator and accident class considerations
  - More frequent initiators require better core damage prevention
  - No individual accident class contributes more than 10% to frequency guidelines
  - Accident class defined as *“group of accidents that require the same plant response to prevent core damage or containment failure”*
  - Should not have to design for rare initiators (e.g., not have to design mitigative features for vessel ruptures)
  - Some initiators render a defense-in-depth element ineffective and need to be compensated by making other defense-in-depth elements stronger (e.g., ISLOCAs bypass containment)



# LARGE RELEASE FREQUENCY GUIDELINES

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- ▶ LERF guideline emphasizes early containment failure
- ▶ Early containment failure most critical for ensuring public health and safety
- ▶ Late large release frequency (LLRF) guideline for late containment failures
  - Health effects
  - Worker protection/Severe Accident Management Guideline implementation
  - Environmental contamination

# CONSIDERATION OF UNCERTAINTIES

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- ▶ Quantitative guidelines apply to mean values, but need to consider the causes in the spread of the distribution
- ▶ Three categories of uncertainties: parameter, modeling, completeness
- ▶ Parameter uncertainties can be addressed by redundancy, diversity, independence single failure criterion
- ▶ Modeling uncertainties can be accounted for with safety margin and acceptance criteria
- ▶ Completeness uncertainty can be accounted for with defense-in-depth and safety margin

# ISSUES

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- ▶ ***Should selective implementation within a regulation of the technical requirements be allowed?***
- ▶ ***Should safety enhancements be required to pass backfit rule?***
- ▶ ***Should there be a reverse backfit test for burden reduction?***

# RISK-INFORMED 50.44

# 50.44 REQUIREMENTS

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- Analytical Requirements
  - postulated LOCA
  - degraded core accidents
  - H<sub>2</sub> source term based on fuel cladding oxidation and 5%/75% metal-water reaction
- Physical Requirements
  - measure H<sub>2</sub> concentration in containment
  - insure mixed atmosphere in containment
  - control combustible gas concentrations
  - inert Mark I and II containments
  - install high point vents in RCS
  - install H<sub>2</sub> control system for Mark III and ice condensers

## 50.44: Licensee Compliance

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Physical Requirement	Predominant Means of Compliance
Measure H2 concentration	Safety-grade continuous H2 monitors
Mixed containment atmosphere	Natural convective cooling, air return fans, or containment spray
Post-LOCA H2 control	Safety grade recombiners
Inert Mark I and II containments	Nitrogen inerting system
High point vents	Vents installed per 50.44
H2 control for Mark III and ice condenser containments	Safety-grade AC powered igniters

# 50.44: Related Regulations and Implementing Documents (Examples)

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- Appendix E to Part 50: *“Emergency Planning and Preparedness for Production and Utilization Facilities”*
  - Continuous H<sub>2</sub> monitoring required for Emergency Response Data System
- 50.46(b): *“Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors”*
  - Specifies maximum H<sub>2</sub> generation in postulated LOCA for purpose of complying with ECCS acceptance criteria
- RG 1.97: *“Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident”*
  - Establishes that hydrogen concentration in the containment and drywell is a Type C variable (i.e., safety grade)

# RISK SIGNIFICANCE

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- ▶ Each core damage/melt accident can potentially produce combustible gases (both H<sub>2</sub> and CO) from both fuel cladding oxidation and core-concrete interaction
- ▶ CCFP from combustible gases range from 0.1 to 1.0 depending on containment type and accident sequence
- ▶ Internal fire and seismic CD sequences have the characteristics of SBO
- ▶ H<sub>2</sub> combustion not a challenge to containment integrity in short term:
  - large dry and subatmospheric due to large volume
  - Mark I and II due to inert atmosphere
  - Mark III and Ice Condenser due to igniters
    - Except for station blackout
    - Except for high pressure melt ejection for Mark III
- ▶ Combustible gas concentration may be sufficient to challenge containment integrity in long term
  - Combustible gases from core-concrete interaction for large dry, ice condenser and Mark III containments
  - O<sub>2</sub> generation from radiolysis can lead to de-inerted atmosphere Mark I and II



# A RISK-INFORMED 50.44

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- Accident types
  - ⇒ core melt accidents
- Combustible gases source term
  - ⇒ realistic calculations
  - ⇒ fuel cladding oxidation and core-concrete interaction
- Controlling combustible gases
  - ⇒ both early and late

# RISK-INFORMED 50.44

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## **Utilize analysis that:**

- Accounts for core melt accidents
- Accounts for combustible gas generation from fuel cladding oxidation and core concrete interaction
- Is based on realistic calculations to specify the amount and rate of combustible gas generation (in regulatory guide)

# RISK-INFORMED 50.44

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## ***Physical Requirements:***

- Alternative 1: Modify the individual requirements
  - Eliminate requirement for safety-grade, continuous monitors
  - Add capability to measure long-term H<sub>2</sub> conc. under degraded core conditions
  - Insure mixed atmosphere for risk significant accidents (e.g., SBO)
  - Eliminate post-LOCA H<sub>2</sub> control (e.g., recombiners)
  - Add long term H<sub>2</sub> control for risk significant core melt accidents
  - Insure H<sub>2</sub> control for risk-significant core melt accidents (e.g., SBO) for Mark III and ice condensers
- Alternative 2: Eliminate the individual requirements
  - Replace with performance-based requirement to control combustible gases for all light-water reactors for the risk significant accidents
- Require conforming changes in other regulations

# SCHEDULE

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- ▶ Provide recommendation to Commission in August 2000, including any policy issues
- ▶ Given Commission approval, proceed to rulemaking (NRR) and regulatory analysis