1 Whereas a confinement you're much less driving force
2 for. A lot of people -- not an original thought on my
3 part -- a lot of people have looked at that, and we
4 see the Europeans, especially in Sweden, moving to
5 these hybrid kinds of designs where they achieve some
6 period of retention, and then they deliberately open
7 up the containment and do a vented filter design and
8 what not. Is that something that the Commission needs
9 to be aware of as an alternative between classic
10 pressure vessel-type containments and say Savannah
11 River-type containments?
12 MR. KING: It seems to me those concepts
13 -- if those concepts met the criteria that were being
14 proposed, then any of those would be acceptable. So
15 to me it's not an issue -- a question of do we want
16 the Commission to pick one concept over another at
17 this point, although maybe it's worth mentioning. I
18 don't disagree with that, but I'm --
19 MEMBER POWERS: It's really the only
20 question I'm asking is if in your background you need
21 to comment on these hybrid-type designs?
22 MR. KING: No. I think in the background
23 that's probably a good idea.
24 MEMBER POWERS: Yes.
25 MR. KING: Okay. Let me say something

1 else about security. I think from external threats,
2 the question of leak-tight versus non-leak-tight is to
3 me not a security issue. Now, when you -- I don't
4 know what's going to help security in terms of
5 internal threats and then it might have some bearing
6 on what kind of core damage you need to assume, and
7 that should drive you to the leak-tight versus non-
8 leak-tight decision. So I think there is some link in
9 security when you're talking internal threats. That's
10 my own personal opinion. All right. I have five
11 minutes.
12 The last one is emergency preparedness.
13 What the designers have proposed is in the extreme to
14 shrink the EPZ down to the site boundary. This was
15 looked at in the past as well. The Commission at the
16 time said, "We're not ready to do that. Let's keep an
17 open mind, but we're just not ready at this point."
18 Basically, we talked about this at the workshop and
19 basically what it boiled down to was a discussion of
20 in the near term this seems to be a moot issue for two
21 reasons.
22 One, for HTGRs, which are probably the
23 most likely near-term non-LWRs, the regulations
24 already allow a provision for case-by-case
25 determination of the EPZ. For the early site permits

1 that are being talked about, they're all being
2 associated with existing sites which have the EPZ
3 consistent with today's regulations and all the other
4 things that go along with emergency planning, so it's
5 sort of a moot issue for those.
6 So the thought was we don't really need to
7 deal with this issue now. Perhaps what we ought to do
8 is let the designs progress, and then if at some point
9 in the future it becomes an issue, deal with it then.
10 Maybe we'll have more experience, more testing under
11 our belt, whatever. So that's the recommendation
12 we're making to the Commission.
13 MEMBER ROSEN: You're aware of the Gen IV
14 objectives.
15 MR. KING: The Gen IV objectives are, yes,
16 basically no off-site impact.
17 MEMBER ROSEN: Yes. The whole idea was
18 that you wouldn't need this, and that set a very
19 stringent bar for the Gen IV plant.
20 MR. KING: But, again, Gen IV is 20 years
21 down the road.
22 MEMBER ROSEN: Yes, I know. But something
23 would have to be done different with this if the Gen
24 IV plants were to be a reality.
25 MR. KING: Again, we're not trying to say

1 no forever, we're just trying to say we don't have to
2 deal with this right now for these near-term designs.
3 So let's wait a little bit and see how things develop.
4 Anyway, that's the presentation. Let me
5 just say a couple words in summary. What this paper
6 is trying to do is get direction from the Commission
7 at high level on these issues. There's a number of
8 implementation aspects that have to be dealt with, but
9 we would propose to deal with those after the
10 Commission points one way or the other how to go on
11 these issues. So we recognize there's a lot of
12 follow-on work. We'll be back to the Committee a
13 number of times on a number of issues, and some of
14 these are linked together in sort of a package deal
15 the way we've put the paper together. So with that,
16 I'll --
17 MEMBER ROSEN: I'd like to come back to
18 the Gen IV point for another reason. You need to make
19 sure that whatever you do at this particular point
20 that you don't deincentivize Gen IV from attempting to
21 read this thing. You need to make it very clear that
22 this could be -- this could be addressed again in the
23 future. Because if this is it and somebody reads it
24 as forever, then all kinds of different things might
25 happen in the Gen IV --

1 CHAIRMAN APOSTOLAKIS: But Gen IV won't
2 pay much attention to regulatory matters.
3 MEMBER ROSEN: They will.
4 MR. KING: I think it's a good point.
5 CHAIRMAN APOSTOLAKIS: Maybe this will be
6 a good incentive for them.
7 MEMBER KRESS: I don't think it's only a
8 good point, I think you devise your regulations to do
9 what you want to and let the plants worry about how to
10 meet them.
11 MR. KING: Well, except on this one we're
12 not saying, no, at this point, we're saying let's put
13 that off, let's defer this one to a later --
14 MEMBER KRESS: Of course EPZ, that could
15 be considered just an element of defense in depth and
16 say we are goinmg to require it.
17 CHAIRMAN APOSTOLAKIS: Okay thank you.
18 Tom are you happy with that?
19 MEMBER KRESS: Yes, very happy with that.
20 CHAIRMAN APOSTOLAKIS: Okay we will come
21 back at 1:30.
22 (Whereupon, the proceedings in the above-
23 entitled matter went off the record at 12:02 p.m. and
24 went back on the record at 1:32 p.m)
25

A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

(1:32 p.m.)

CHAIRMAN APOSTOLAKIS: The meeting will come back in session.

The next item is the draft final American Nuclear Society standard on external events methodology. The cognizant member is Dr. Powers.

Dana.

MEMBER POWERS: We're going to discuss yet another of the standards that are getting proliferated lately on how to write a PRA.

MR. BUDNITZ: No, that's not what our standard is.

CHAIRMAN APOSTOLAKIS: Wait, wait, wait.

MR. BUDNITZ: On the record, if he thinks that's what this standard is, he's off base, and if everything else is predicated on it, then that's all off base.

CHAIRMAN APOSTOLAKIS: This is going to be exciting.

MR. BUDNITZ: It's very, very important that people understand that distinction.

CHAIRMAN APOSTOLAKIS: Your turn will come.

MEMBER POWERS: To correct myself, a set

1 of requirements for PRAs, and those of you that have
2 been on this committee for long enough know that I
3 have struggled and struggled over these what I call
4 soft standards because they're really quit radically
5 different than the standards that you get used to in
6 the metallurgical professions where they kind of say,
7 "Do it this way."
8 There are two ways in the world to do it,
9 the code way and non-code way. And so if you want to
10 comply with the code, you do it this way.
11 These are different because PRA people
12 need lots of flexibility, I guess.
13 This particular standard is going to deal
14 with how you do an external event PRA.
15 MR. BUDNITZ: No, it doesn't deal with how
16 you do an eternal --
17 MEMBER POWERS: The other thing about PRA
18 people is they can split hairs better than the best of
19 us.
20 MR. BUDNITZ: Just speak in plain English.
21 MEMBER POWERS: The external events PRA is
22 a subject of troublesome definitions throughout its
23 history. In the past, fire has been included in the
24 external events PRA, but here it's not.
25 On the other hand, fire is not included in

1 the internal events PRA. The fire is left abandoned
2 someplace, neither in internal nor external, nor is it
3 really provided for in an FDA 805.
4 This --
5 MEMBER SIEBER: May IEEE should do it.
6 MR. BUDNITZ: Well, there's another
7 committee writing fire standards right now.
8 MEMBER POWERS: This particular set of
9 requirements for an external events PRA really focuses
10 primarily on things like seismic events, external, not
11 internal, but external flooding events, high winds
12 like tornadoes and hurricanes and things like that.
13 It has been written to closely parallel
14 the structure that was created by the ASME committee
15 for the internal events PRA in the sense that there is
16 a bunch of capability categories for the PRA, and that
17 has proved to be one of the more challenging aspects
18 of the standard to understand.
19 In addition, it includes material on
20 what's called the seismic margins method for analyzing
21 the plant, and the standard goes to great lengths to
22 try to say, well, that's the kissing cousin of a PRA.
23 Whereas myself, I view them as almost antithetical to
24 each other.
25 The presentation we're going to have today

1 is a little different. We've previously gone over the
2 major structure of this set of requirements for a PRA,
3 and so what Mr. Budnitz has proposed to do is to give
4 us a bit of an introductory to the subject and then
5 throw himself open to ask questions.
6 He did say questions and not heavy
7 objects.
8 MR. BUDNITZ: I'll catch them if you throw
9 them.
10 MEMBER POWERS: And there are lots of
11 things in here that are worthy of trying to understand
12 better. For instance -- see, Bob, I get the
13 introductory. So I get to talk a while -- is that
14 when you think about -- most of the standard deals, as
15 it should, with seismic events. That's by far and
16 away the one that's ubiquitous for nuclear power
17 plants. Most of it deals with the seismic events.
18 And when you think about seismic events,
19 what do they do? Well, seismic events knock things
20 down, break things, and cause fires.
21 The standard deals a whole lot with
22 knocking things down and breaking things and really
23 deals very, very little with fire, and in fact, does
24 not invoke an appeal to something that would deal with
25 fire for you the way it does with internal events.

1 In fact, the standard is predicated on the
2 availability of an internal event, but it is not
3 predicated on the availability of a fire PRA. That's
4 an issue that I think I would like to understand more
5 about.
6 The difficulty with soft standards like
7 this is that you look around and you say, "Now, how do
8 I know that this set of requirements is both necessary
9 and sufficient?"
10 You know, if I follow this, that I will
11 get an adequate PRA, and they don't provide evidence
12 of this. It's quite different, again, than the
13 standards we have like in structural mechanics and
14 whatnot.
15 And I had reasons to raise this question
16 earlier with Bob, and he gave me the good advice. He
17 said, "Well, you're taking the judgment of experts,
18 and if you trust those experts, then that's how you
19 judge the necessary sufficiency of these," and I
20 though that was probably the right answer here.
21 What I find interesting is that you look
22 at this panel, the working group that put it together,
23 and you say, "Gee, how many of these people have
24 actually prepared a seismic PRA so that I have some
25 confidence that this set of requirements can be done

1 and that it will be adequate when the product goes
2 out?"
3 And I don't know the answer to that.
4 So with that introduction and background
5 on what we're going to hear about, I guess I'll turn
6 the floor over to Bob. He will give his introduction,
7 and then I guess he will throw himself open to
8 questions, and he says he will catch bricks if thrown
9 at him.
10 MR. BUDNITZ: Yeah. Okay. Thanks, Dana.
11 And you can ask both of those questions
12 again because I'm not going to try to answer them here
13 directly.
14 I've just got to tell you a little
15 history. The ASME standard began in early '98. About
16 a year later, in the spring of '99, the ANS -- the
17 ASME standard is internal events PRA methods -- the
18 ANS took it upon itself with ASME's concurrence and
19 understanding that ANS would develop a standard for
20 external events PRA methodology that would we always
21 use the word "be hand and glove with the other." They
22 could be used together. That was the objective.
23 You want to have them both on the table in
24 front of you if you're an analyst or a reviewer, and
25 they should be able to be used together just as if it

1 was another chapter.

2 And with that objective in mind, the ANS

3 appointed a working group -- you see them in front of

4 you -- in the sort of September time frame of '99.

5 I've been the chair right along, and the straight

6 truth is the standard is written by Ravi Ravindra,

7 Nilesh Chokshi and me. We wrote it.

8 The other three didn't write a thing, but

9 they were crucial reviewers in the first draft. Let

10 me be sure you understand what I mean. We decided

11 rather early that it was easier for a smaller group

12 and we were willing and able; easier for a smaller

13 group to write something than a bigger group.

14 In fact, ASME's curse -- and I was on that

15 committee -- was there were 18 people, 14 of whom were

16 trying to write something. It's very, very hard, and

17 it wasn't necessary. In fact, it's actually

18 counterproductive.

19 So the three of us wrote it: Ravindra,

20 Chokshi, and me. And Stevenson, Henries, and Yee

21 were, as I said, first round reviewers before it went

22 anywhere else, in fact, before you know -- as soon as

23 something was on paper, sent to everybody; they were

24 there. And that was a crucial piece.

25 Now, to answer your question about PRA,

1 all six of us have actually performed seismic PRAs, a
2 lot of them. We're practitioners.
3 The number of practitioners in this field
4 is only a couple dozen, and you probably know a lot of
5 them, both on the systems side and on the hazard side,
6 and we worked along from the fall of '99 until the end
7 of the year 2000, about a year and a quarter, and I
8 actually clicked off -- that's what you do nowadays
9 with your computer. You click and it's done -- sent
10 off the draft, first draft, for public comment on
11 December 25th, 2000, a date to remember for those of
12 you who are Christians, and it went out for public
13 comment the week after the New Year.
14 And you got it for public comment, too.
15 Public comment period ran from early January to early
16 April, and you got it. And I was here in February, I
17 think February 2 or 3, 2001, right here discussing it
18 with you, and you commented, too.
19 And by April 2001, we had a whole lot of
20 comments on that draft, which took a long time to try
21 to sort out.
22 We have an oversight committee, the ANS,
23 like ASME, has an oversight committee that oversees
24 the working group, and that committee met in perhaps
25 September. I think that's right, September 2001.

1 Six months had passed since the close of
2 the public comment period, and in a couple of days,
3 sorted through what their guidance was to be on a
4 couple of very crucial issues, and I'll explain them
5 in a minute.
6 And then we went off in perhaps October of
7 2001 and wrote it again. Because everybody here is a
8 volunteer, these things don't get done in a day, but
9 by April we had another draft, April of this year,
10 2001. It was about six months later.
11 And we sent that out both to the parent
12 committee and for public comment, and the balloting
13 ended in August, I guess, and we got favorable ballots
14 from all but three or four parties. I'll explain that
15 in a minute, what we got back.
16 And even though the balloting was
17 positive, we got a whole lot of comments, but mostly
18 little stuff, a lot of little stuff, which had to be
19 incorporated, and I have now, with Ravi and Nilesh, I
20 have now pulled that together, and just three weeks
21 ago perhaps I sent off what we think is the final
22 version to you.
23 But what you have is also the final
24 version that has gone back to the committee. The
25 committee balloting, by the way, was positive, even

1 though I guess there were four negatives, and I'll
2 tell you about that in a minute. I'll tell you what
3 the issues were.
4 We also got a lot of public comments. You
5 know, people send in comments. So we incorporated
6 them, a whole lot of little stuff, nothing really
7 crucial except some things we couldn't accommodate,
8 which I'll explain, and that's been complete, and now
9 it has gone back to the committee.
10 The idea is, you know, even somebody who
11 voted yes, maybe I screwed it up as the chairman or,
12 you know, we screwed it up. So they get a chance at -
13 - you don't get a chance at bringing in a new comment,
14 but you get a chance to see whether or not the
15 resolution of somebody else's comment was okay, and
16 that's in the process now.
17 It's a one month thing that started about
18 November 15th, and the week after next it is going to
19 be done, God willing. Three and a half years. Okay?
20 So that's the schedule. Now, the process.
21 It's been a volunteer effort all the way through with
22 one crucial caveat. The Nuclear Regulatory Commission
23 gave the ANS a grant some time in the fall of '99,
24 which paid for administrative costs of the ANS staff
25 and for travel for the group so that we could travel

1 to have meetings.

2 By the way, the grant also covered lower

3 power shutdown standard, which is going on in

4 parallel. We'll talk about that, but that grant is

5 there, and you didn't have to pay for my travel today

6 because I'm now in Washington. You know, I rode the

7 Metro, I won't charge you for it.

8 Now, just one more thing about me, and

9 then I'll talk substance. For the whole duration of

10 this standard I was, as I have for more than two

11 decades, the president of a one man consulting company

12 in Berkeley called Future Resources Associates,

13 Incorporated, and that's what was in the standard.

14 It's me.

15 In all the work that was done with that

16 hat on, I became a Livermore employee several weeks

17 ago, and with Livermore's understanding I'm continuing

18 this in a voluntary effort until we get it done, but

19 none of this has to do with Livermore, although I'm a

20 Livermore employee. That's a disclaimer. It's very

21 important you should know.

22 Furthermore, I was hired at Livermore to

23 go on detail to the Department of Energy Yucca

24 Mountain Project, which is where I'm working in

25 Forrestal now, and nothing I'm saying here has

1 anything to do with DOE or the Yucca Mountain Project
2 either.
3 This work was all done before, and I'm
4 just continuing it to its completion as a volunteer.
5 I just had to say that for the record because you
6 understand why it's important to say that.
7 Now, those procedural things aside, here's
8 what's left. If the balloting from the committee
9 comes back December 15th and everybody does what they
10 do, we hope to turn around the no votes, but one
11 doesn't know.
12 Then the ANS will issue the thing in final
13 form, but there's one more round. Because ANS is one
14 of the standards development organizations under ANSI,
15 the American National Standards Institute, it has to
16 go to ANSI, and they publish it on their thing for
17 another 30 days, and you know, then it's done.
18 And you might get a comment, although when
19 the ASME standard went out, we didn't get any comments
20 in that round. Everybody had done it before.
21 So, you know, it will be another couple of
22 months and then it will be done. All right? So
23 that's the procedural stuff. Now, let me talk some
24 substance.
25 When we had the first round draft, and I

1 said we published it December 25th, 2000, and the
2 commentary went through April, those of you who aren't
3 familiar should know and those of you that aren't,
4 that will remember will remember that we only had one
5 element of requirements, not three like ASME. One set
6 of requirements for everything. You know, there's
7 just one thing to do. No gradations, a graded
8 approach towards the requirements.
9 And the committee came back and said they
10 wanted to have three capability categories just like
11 ASME. So we did that.
12 That turned out to be a completely non-
13 trivial exercise. It was just very -- I mean for us
14 experts, it was very, very difficult.
15 And what was difficult was because we had
16 a very hard time trying to sort out what might go in
17 Column 3 that was separate -- that's the highest
18 capability category -- that was separate from Column
19 2, which is today's sort of state of the art or
20 standard practice.
21 And we also had a terrible time because we
22 had lots of back-and-forth with people that thought
23 that the signs of margin approach should be in Column
24 1. But we argued back with them that signs of margin
25 is not a PRA, doesn't go in Column 1. Column 1 is a

1 PRA of a certain kind, and we fought that off.

2 I mean that. I have to say the word

3 "fought" outright, and so you see those three

4 categories there, and if you want to talk about what

5 they mean, I'll explain exactly what they mean.

6 But for some capability requirement to be

7 in Category 3, it has to have been done by somebody

8 some time somewhere, published, and has been accepted

9 as okay. Okay?

10 CHAIRMAN APOSTOLAKIS: Category 3?

11 MR. BUDNITZ: Yeah. In other words, if we

12 have a requirement in Category 3 that's separate from

13 Category -- you know, some of them go all the way

14 across.

15 CHAIRMAN APOSTOLAKIS: But I thought

16 Category 3 was --

17 MR. BUDNITZ: That's very important.

18 CHAIRMAN APOSTOLAKIS: -- Category 3 was

19 pushing the state of the art.

20 MR. BUDNITZ: No, it's not pushing the

21 state of the art in our interpretation, and I want to

22 make sure you understand. Category 3 for us means

23 that somebody did it somewhere and published it, and

24 we've said it made sense. It wasn't just sort of off

25 the wall or somebody said, "Well, ask Joe."

1 CHAIRMAN APOSTOLAKIS: Let's think about
2 it now.
3 MR. BUDNITZ: It's very important.
4 CHAIRMAN APOSTOLAKIS: You know, you go to
5 the old days when Zion Indian Point PRAs were done,
6 when a small group of people pioneered and did their
7 seismic analysis.
8 MR. BUDNITZ: Yeah.
9 CHAIRMAN APOSTOLAKIS: So that would be no
10 category because nobody had ever done it before.
11 MR. BUDNITZ: Well, we're writing this in
12 the year 2000, George, when we have --
13 CHAIRMAN APOSTOLAKIS: Yeah, but somebody
14 once --
15 MR. BUDNITZ: -- we have 75 PRAs on the
16 shelf, 25 of them overseas..
17 CHAIRMAN APOSTOLAKIS: So if I want to
18 advance the state of the art, I still end up in
19 Category 2?
20 MR. BUDNITZ: If somebody somewhere had
21 done a piece of work in a particular area that we
22 thought was -- you know, had advanced the state of the
23 art as of the year 2000 and we thought that was -- so
24 somebody else could do it, right? So if somebody else
25 didn't have to again, that's what we wrote in Category

1 3. I just want to make sure you understand that
2 that's what we wrote. I'm just --
3 CHAIRMAN APOSTOLAKIS: But I thought the
4 ASME though -- the ASME Category 3 was different.
5 MR. BUDNITZ: No.
6 CHAIRMAN APOSTOLAKIS: The ASME Category
7 3 was the state of the art of --
8 MR. BUDNITZ: No, no, no.
9 CHAIRMAN APOSTOLAKIS: No?
10 MEMBER ROSEN: Good enough to be risk
11 based.
12 MR. BUDNITZ: Yeah, it was a PRA.
13 MEMBER POWERS: When I looked at --
14 MR. BUDNITZ: Just wanted to be sure you
15 understood that. so --
16 MEMBER POWERS: When I looked at the
17 standard, I looked at the requirements in each of the
18 categories. I became hopelessly confused about all of
19 this until I went back and read your introductory
20 paragraph in which you described what the categories
21 are.
22 MR. BUDNITZ: Right.
23 MEMBER POWERS: And I found that suddenly
24 -- I mean, it was very helpful to read, and if you're
25 doing any rewriting, I really recommend highlighting

1 that even more than you do.

2 MR. BUDNITZ: Well, you're supposed to

3 read it from the beginning. I guess you read the

4 newspaper from the back.

5 MEMBER POWERS: I --

6 MR. BUDNITZ: Go ahead, Dana.

7 MEMBER POWERS: I read it, but I think

8 that I didn't pay so much attention.

9 MR. BUDNITZ: Thank you, thank you. We

10 struggle with that.

11 MEMBER POWERS: It's worth reiterating, I

12 think, that the categories represent different states

13 of resolution of the result. That is, if I want

14 resolution only to the level of trains, then I do a

15 Category 1. If I want it to the resolution of

16 components, I do Category 2. And if I want a finer

17 resolution, then I do Category 3.

18 CHAIRMAN APOSTOLAKIS: Failure modes, in

19 other words.

20 MEMBER POWERS: Yeah, yeah. And suddenly,

21 before when you would go through and you'd look at

22 these categories and you'd say all of the things that

23 they are requiring here are the same for all of the

24 categories. What does this mean? I mean, there's no

25 difference here.

1 Then when I reminded myself it's a matter
2 of resolution; yeah, the requirement is the same, but
3 the way you apply the requirement is at a different
4 level of resolution, then it all makes perfect sense.
5 It's just fine after that.
6 MR. BUDNITZ: Well, I guess, just to be
7 sure you understand, and it's on Table 1.1, something
8 is in a higher category if it has either more scope or
9 level of detail or more plant specificity versus
10 generic or more realism versus conservatism. Any one
11 of those picks it up. More of them pick it more.
12 CHAIRMAN APOSTOLAKIS: As long as somebody
13 else has done it first.
14 MEMBER POWERS: And none of that -- yeah.
15 None of that helped me --
16 MR. BUDNITZ: No requirement in here is
17 something that no one has ever done.
18 MEMBER POWERS: None of that --
19 MR. BUDNITZ: That's very important.
20 MEMBER POWERS: None of that plant
21 specificity of whatnot helped me a bit. It was the
22 level of resolution that really made it much more
23 palatable to read what you had written.
24 MR. BUDNITZ: Thank you.
25 CHAIRMAN APOSTOLAKIS: Does that apply to

1 the ASME standard as well?

2 MEMBER POWERS: Well, I don't know that.

3 MR. BUDNITZ: You're more expert on that.

4 CHAIRMAN APOSTOLAKIS: I'm not sure. I

5 don't remember that.

6 MR. BUDNITZ: George, I think so.

7 MEMBER POWERS: But it didn't matter. I

8 liked it.

9 CHAIRMAN APOSTOLAKIS: No, I like this,

10 too, but I don't remember ASME saying the same thing.

11 MR. BUDNITZ: All right. I think so. So

12 let's go on.

13 We had a terrible time trying to sort out

14 how to write the three categories, and so you'll see

15 that most of the requirements --

16 MEMBER POWERS: You --

17 MR. BUDNITZ: -- most of the requirements

18 -- because we had to sort out what this meant to us,

19 and we're supposed to be the experts, practitioners.

20 Most of the requirements go all the way

21 across, which really means the same words apply, but

22 if you have more specificity, you can claim you're in

23 another category, see, or if you have more -- more --

24 MEMBER POWERS: More resolution.

25 MR. BUDNITZ: Right.

1 MEMBER POWERS: Well, you know, I mean,
2 see, that bothered me a lot because sometimes you're
3 doing it for us and sometimes it's just two
4 categories, things like that. But when you interpret
5 it in terms of resolution --
6 MR. BUDNITZ: That's a fair comment.
7 MEMBER POWERS: -- then suddenly you say
8 it doesn't matter if it goes all the way across. This
9 is just illustrating for you that there are different
10 levels of resolution in the PRA, and the requirements
11 probably are the same for all three of them. The high
12 level requirements are all the same. It's just a
13 matter of resolution.
14 MR. BUDNITZ: Right. So let me go on. I
15 have two more things to say, and then I'm going to
16 turn it to you. One has to do with uncertainty.
17 This standard from the start imbeds
18 uncertainty issues, uncertainty requirements about
19 developing and expressing and writing down and
20 analyzing uncertainties in a way that is intrinsic to
21 everything that we've done.
22 If you read it and you don't see it,
23 you're blind. It's in there everywhere. We were
24 careful about that. It meant a lot to us.
25 MEMBER POWERS: Even in the lowest

1 category.

2 MR. BUDNITZ: It meant a lot to us.

3 Now, I'm contrasting that with the ASME

4 standard on which I was a member. I was one of the

5 18, in which that's absent, and by the way, it's

6 glaringly absent, and I can tell you that in some

7 discussions inside the committee, there was a

8 minority, of which I was one, that wanted that, and we

9 got outvoted.

10 I'm not going to throw any mud at the ASME

11 standard. This thing has uncertainty all the way

12 through. You can't do a seismic PRA, in my view, of

13 any kind unless you're attentive to that because the

14 insights and result and what you do with it depends so

15 much on understanding roughly or -- do you want to do

16 more, better? -- what those uncertainties are and

17 where they arise.

18 CHAIRMAN APOSTOLAKIS: Is this uncertainty

19 modeled?

20 MR. BUDNITZ: Some of it's modeled

21 uncertainty and some of it has to do with data.

22 Certainly in the hazard side, it's data driven in the

23 sense that we don't have a lot of earthquakes and so,

24 therefore, there's a lot of uncertainty in the hazard

25 even in California. Never mind in the East -- which

1 is driven by we don't have a lot of earthquake data,
2 but there's also quite a bit of model uncertainty,
3 too, and we go into that.
4 And I just want to point that out because
5 if you're not attentive to what you should be, and I
6 hope you are.
7 Okay. Now, that comment having been said,
8 we then had to struggle with this three capability
9 category issue in that way, and it took us a long
10 time.
11 Nilesh and Ravi and I spent a long time
12 dealing with that, and I think we came out okay, and
13 I'm pleased with it. We sent it out to the committee,
14 and we didn't get almost anything back on that from
15 anybody, public comments or our oversight committee or
16 anything. So that either tells you they missed it or
17 they liked it.
18 Now, the one other issue I want to be sure
19 to talk about and then I'm open for you is now I'm
20 going to stop right here and talk about earthquake
21 caused fires.
22 Earthquake caused fires are not here.
23 That's what Dana said. They're not here. Earthquake
24 caused fire when you do a PRA for an earthquake caused
25 fire, if you really want to work out the core damage

1 frequency, it's mostly a fires PRA question.

2 There's another committee under ANS

3 developing a fire PRA right now. Dennis Hennecke is

4 its chair, and Nathan Siu is the NRC member. There's

5 five or six other people. They're doing that now.

6 It's a year and a half away.

7 And when that's done, then you can come

8 back to us and you can ask the question about whether

9 an earthquake would cause a short in something that

10 would cause an initiating event for a piece of

11 equipment, and then it goes into the PRA.

12 So that's why it's absent, and I think

13 it's rational that it's absent. We just need that

14 standard because all of the earthquake becomes -- is

15 an initiating event for what then becomes the fire

16 PRA. So just answer that, why that's missing. Okay.

17 MEMBER POWERS: Well, but can I ask you a

18 question about it?

19 MR. BUDNITZ: Sure.

20 MEMBER POWERS: You don't have a structure

21 for it right now.

22 MR. BUDNITZ: Correct. We're going to

23 have to develop that after.

24 MEMBER POWERS: And, on the other hand,

25 you're perfectly willing to cite unpublished standards

1 on seismic things.

2 MR. BUDNITZ: I don't understand that last

3 thing there.

4 MEMBER POWERS: You've got two -- you call

5 out two draft standards.

6 MR. BUDNITZ: Yeah, but we don't rely on

7 them. We only just mention them. There's nowhere in

8 the standard are they in any of the requirements.

9 MEMBER POWERS: Why can't you mention this

10 fire standard that's coming forth?

11 MR. BUDNITZ: Because the ANS 227 and ANS

12 229 have actually been published for public comment,

13 and therefore are widely available in the community.

14 The other thing, there's not a single word

15 that has been put on paper yet. They've only had two

16 meetings. So there's nothing --

17 MEMBER POWERS: And you can't call NFPA

18 805?

19 MR. BUDNITZ: I suppose. What we did is

20 like observe like the lower power shutdown standard

21 that's under development, but ANS 227 and ANS 229,

22 which by the way if you don't know what they are,

23 they're standards in development for seismic hazard,

24 but they've not been published.

25 And so we've taken them out of the

1 requirements because by rule you can't have a
2 requirement.
3 MEMBER POWERS: Requirement, right.
4 MR. BUDNITZ: But we mention them in the
5 text as being there if you want to know, and so there
6 --
7 MEMBER POWERS: NFPA 805 is a public
8 standard.
9 MR. BUDNITZ: Yes, but it's certainly not
10 a PRA standard of any kind.
11 I yield to the prior experts in the room,
12 although I think I'm one, too. We decided to refer to
13 805 would be erroneous, misleading, and we didn't do
14 it on purpose.
15 If you want to write in your letter that
16 we should, we will probably reject your writing.
17 Okay? I'll just be as direct as I can be.
18 You're not going to get me as the chairman
19 of this committee to refer to that because it's not a
20 PRA standard, and the PRA appendix in the back is
21 useless.
22 CHAIRMAN APOSTOLAKIS: Other than that,
23 what --
24 MR. BUDNITZ: For these, for these
25 purposes. Right? Just leave that unless you want to

1 --

2 MEMBER POWERS: Well, you can come in and

3 say the same thing. As a seismic -- as an external

4 hazard, the thing is useless because if there's one

5 thing that earthquakes do, it's they knock things down

6 and they start a fire. You deal with half of it. You

7 don't deal with the other half. You're useless.

8 MR. BUDNITZ: No, it would be misleading.

9 In any event, if you want to go after me

10 on that, fine. I was coming back from Argents

11 (phonetic) because I wanted to just talk about -- this

12 is the main issue that held us up for two years.

13 Let me back up. In 1984 and '85, NRC,

14 DOE, and EPRI jointly sponsored an expert panel, and

15 I was the chair, to develop a method that became known

16 as the seismic margin method, and it's intention -- if

17 you don't know what it is, I can't get into the

18 details here -- but its intention was to develop a

19 method whereby an analyst could go to a nuclear power

20 plant and develop what we call the HCLPF capacity, the

21 high confidence low probability of failure capacity,

22 for components and ultimately through certain

23 algorithms success paths, and ultimately the plant.

24 In order to ascertain what the HCLPF

25 capacity was or a bound on it that then might be

compared with some figure of merit somebody might dream up --

MEMBER ROSEN: You might want to say that more slowly for our recorder, the HCLPF.

MR. BUDNITZ: H-C-L-P-F, HCLPF, the word HCLPF. We pronounced it "hiccliff." It stands for high confidence of low probability of failure, and it's a capacity of a component or ultimately you can combine them, of a system or of maybe the whole plan.

And I chaired that thing, and that method was intended to enable somebody who had a nuclear power plant to be able to say that they had a lot of margin if they did above the design basis.

For a typical plant a design basis might be 215.5(g), and if their HCLPF capacity was .3, they could say that if it were so. That was its intent.

In 1989, five years later, the NRC endorsed the seismic margins method for use in the IPEEE, a grievously erroneous decision, in my view, that I counseled them against, and I was in the position to counsel them.

And half of the plants went and did them instead of a PRA for the IPEEE. Okay. Half of the plants have a seismic margin review. The other half have a seismic PRA, and they all, by the way, now have

1 an internal events PRA, as you know, although you
2 didn't have to do a PRA for the IPEEE remember, but
3 they all have them.
4 Now, when we started this standard in '99,
5 the plants that had a seismic margin review said --
6 and it's perfectly acceptable and correct to say --
7 "Golly, we'd like to be able to say that if we've got
8 a good seismic margin review," good meaning they met
9 the -- right? -- "we ought to be able to say that, and
10 we can say that."
11 So we wrote requirements for the seismic
12 margin method, and if you got a plant with a seismic
13 margin review and you check off the boxes, you can
14 say we met the standard. Okay? And that's fine, and
15 that's what those requirements are. Nothing more,
16 nothing less.
17 On the other hand, if you have a PRA,
18 there's more. I can go into more if you want.
19 Now, here's the problem. The problem is
20 that a seismic margin review is taken absolutely
21 straight off the page without any enhancements,
22 provides for the analyst for his plant capacities for
23 what we hope are the important pieces of equipment or
24 structures, but not even fully, you know, fragilities;
25 just HCLPF capacities, which is the high confidence,

1 low probability capacities, and then you can combine
2 them to work out the capacities of what is known as a
3 success path.
4 Actually the requirements are that you
5 have to develop two success paths, and the success
6 path, you know, you might -- the success path meaning
7 you have to do this, you have to do this, you have to
8 do this, and you have to do this, and then you can
9 shut down your sink (phonetic).
10 And so it works out the HCLPF capacity --
11 it's called A, B, C, and D. You have to work out the
12 HCLPF capacity of A, B, C, and D, and the HCLPF
13 capacity of the success path is the weakest of those
14 because it's the smallest earthquake that would
15 compromise one of them, and that's how the method
16 works, and it not more or less -- and then if you have
17 two success paths, one of them has a HCLPF capacity of
18 .4 and the other has a HCLPF capacity of .5, but the
19 HCLPF capacity of the plant is .5 because you could
20 use the second one, and therefore, you can shut down
21 even for a larger earthquake.
22 And that's all it is. It doesn't have any
23 probabilities in it. It has nothing to do with the
24 hazard. In fact, the whole idea in 1984 was getting
25 away from the problems with the hazard to work out

capacities.

And so if you've got one of those, it's a marvelous tool if what you want to do is go to your plant and say, "Golly, I've got a pump or a valve or a shear wall, and I want to make sure it has a certain capacity."

It tells you that. Okay? But it can't be used in probabilistic space. But we had members of our oversight committee, including a couple that voted no this time -- and I'll tell you about that in a minute -- who insisted that an SMA was really a lower PRA, and they got outvoted by the parent committee. All right?

But that still was here, and we even got comments about it, you know, in the last round. SMA is not a PRA in any way, but we have requirements for it. So if you've got one, you can use it.

It's wonderful for risk informed applications of a certain kind. Let me give you an example.

Suppose somebody has got a valve, and they want to petition the NRC. They want to change the allotted outage time from 24 hours to 96 hours, and somebody in the back of the room says, "What about seismic?"

1 You can go to your seismic margin analysis
2 and you can look it up and see that that's a five G
3 value suppose in this. And the seismic margin method
4 tells you that. You can put that on the table, and
5 you walk away from that valve. Seismic.
6 Well, okay. So that's wonderful. Very
7 limited applications, but for those applications, it
8 really does the job, and that was what the intent was.
9 MEMBER ROSEN: The five G valve --
10 MR. BUDNITZ: Yeah, yeah.
11 MEMBER ROSEN: -- means it could stand
12 five Gs and still function.
13 MR. BUDNITZ: Right. A five G valve
14 meaning that at five Gs it still functions fine.
15 So you say, gee, for seismic it's no
16 problem, and so there's an application, right? Trying
17 to do something else, and somebody asks a seismic
18 question, and this is a very strong value. Seismic
19 margin didn't have to tell you that, right? But if
20 it's a .15 G value, you can't use it for anything
21 because you don't know how it combines with the other
22 systems, the components, and stuff like that to make
23 risk because it's not there. It can't be there. It's
24 just not there.
25 So I spent a year, from mid-'01 to mid-

1 '02, struggling with several committee members on the
2 parent committee with what to do about the fact that
3 they weren't going to agree to this standard unless we
4 said something more about seismic margins.
5 And so the outcome of that is Appendix D,
6 which I know you have. Appendix D is a discussion
7 which I wrote with Gene Hughes from ERIN Engineering,
8 which describes what a seismic margin analysis can do
9 and what it can't do as is.
10 It also describes what you could do if you
11 enhanced a seismic margin analysis you have, you know,
12 in certain ways so that you get more out of it. There
13 are five or six -- I can't remember how many -- but
14 there are five or six different kinds of enhancements.
15 In the end you can actually make a PRA out
16 of it because a lot of the work has already been done
17 for you, you know, the capacity work, and if you have
18 an internal events PRA you've got the event tree,
19 fault trees, you know, get started.
20 And after back and forth and forth and
21 back and back and forth, and so on for half a year, a
22 year, we finally have an appendix that describes that
23 in a way that's satisfactory to just about everybody,
24 and now we're out with it.
25 Now, that was a terrible struggle, and the

1 reason it was a struggle was that many proponents of
2 seismic margins -- and I have to then say maybe plant
3 owners who were duped into it, and I'm just trying to
4 be as direct as I can be. D-u-p-e-d, reporter. Were
5 duped into it -- thought they had a PRA when somebody
6 sold them a seismic margin, and they don't, and
7 they're mad, and they want to use, and it they can't.
8 And they shouldn't be able to because it's wrong. You
9 can't.
10 We had to beat that down, and we have.
11 It's very important you should understand. It went on
12 for a year. The seismic margin review was not a PRA
13 of any kind. It's not even a lesser PRA because it
14 doesn't have probabilities, the first word in PRA.
15 In any event, that appendix is there.
16 People are happy with it, and finally we're done.
17 Now, let's talk about the negative votes.
18 I can't remember how many the committee is. Twenty-
19 five or six. Steve is on it.
20 MEMBER ROSEN: You're talking about the
21 RIS, R-I-S --
22 MR. BUDNITZ: Yeah, yeah, the ANS
23 committee.
24 MEMBER ROSEN: American Nuclear Society's
25 Risk Informed Standards Committee, RISC. Yea, I am on

1 it, but I did not vote --

2 MR. BUDNITZ: That's correct.

3 MEMBER ROSEN: -- because of my role in --

4 MR. BUDNITZ: I understand you abstained

5 from that.

6 But there's 25 or six members. I can't

7 remember. I could look it up, and four people voted

8 no in the round, you know, in August, and I'll explain

9 what they were.

10 Jim Klaproth from G.E. voted no on the

11 following basis. He said that he thought that the

12 standard shouldn't have any peer review requirement

13 because peer reviewers are a very small community,

14 most of whom are on this committee, writing it to make

15 work for ourselves.

16 I thought that was a low blow, and I'll

17 just say that in public so it will be on the

18 transcript.

19 And, well, that's wrong. We have peer

20 review for a reason. It's part of the philosophy.

21 Okay.

22 Allan Camp voted no because he didn't like

23 the -- Allan Camp is from San Diego -- he voted no

24 because he didn't like the peer review requirements,

25 and after we changed some of them, he's voted yes now.

1 Gene Hughes voted no because in the end he
2 didn't like the seismic margins write-up, but I hope
3 I can turn him around in the next week or two because
4 we've talked, and maybe he'll change his mind. I sure
5 hope so.
6 MEMBER ROSEN: That's astonishing. I
7 thought he wrote it with you.
8 MR. BUDNITZ: He wrote it with me, and so
9 it did astonish me, but I'm just telling you what it
10 is.
11 Bill Bohlke from Exelon voted no with
12 about 20 different little comments, all of which we
13 have responded to and sent it back, and I hope he'll
14 vote yes this time, but I"m just going to have to wait
15 and see.
16 And then finally, Nuclear Regulatory
17 Commission voted no -- that's very important -- on the
18 basis that --
19 CHAIRMAN APOSTOLAKIS: Even with Nilesh
20 and you writing it.
21 MR. BUDNITZ: -- on the basis that we
22 should have the SMA in there at all because it's not
23 risk informed and can't be used in risk informed, and
24 I tried to rebut that in revision of Appendix D, and
25 I think I've got them on board, but we're going to see

1 in the next week or two whether they're on board and
2 they vote yes.
3 But in any event it doesn't matter. We're
4 going ahead without them. We've got the votes, and
5 we're going ahead without them. They know that, see,
6 because in fact, it doesn't make sense to us what they
7 said.
8 I told that to Mark Cunningham and Mark
9 Rubin directly on the phone, who were the two people
10 on the committee, you know, voting, and so we'll see
11 how that comes out.
12 But their basis was that they didn't think
13 SMA should be in there at all. Three or four years
14 after it has been in there, and I hope, you know, --
15 we were on this for a long time, and it was
16 frustrating for -- remember we're volunteers.
17 So I'll just leave you at that. I guess
18 I have just one more comment, and then you can ask
19 anything you want, of course, thank God. I'm glad
20 you're here.
21 In fact, what Dana said is completely
22 true, that there is no evidence -- I wrote down on my
23 pad what he said -- that the standard and the
24 requirements therein are both necessary and
25 sufficient.

1 There isn't, and the reason for that is
2 it's not deductive. It's inductive. Okay? The ASME
3 standard is an inductive standard. I don't know how
4 intellectually to produce such evidence that what we
5 have is sufficient; there isn't something missing; and
6 that what we have is necessary. There are the right
7 things there that there shouldn't be.
8 You know, I can't intellectually find a
9 way to conclude that from this. It's inductive. So
10 in that sense Dana's initial comment is correct, but
11 it's in the nature of something like this, a
12 methodology standard, and its validity comes from the
13 review of practitioners. And over these years we
14 don't know any PRA practitioners in the world, by the
15 way, really who haven't commented on them.
16 We sent it to everybody, you know, not a
17 big community, and they've seen it, and people are on
18 board about it. So I can't defend to you that it's
19 either necessary or sufficient in terms of the
20 requirements and their what makes them hang together.
21 I just have to explain to you that it is by its
22 character not deductive, but inductive, and take it
23 from there.
24 That's sort of a -- it's more than a
25 philosophical point because unlike, you know, the

1 design of a vessel to hold certain pressure, there's
2 nothing that's rigorous that you can start from first
3 principles with, laws of physics, and the like, and
4 then properties and materials. Put something together.
5 It's just not like that.
6 MEMBER POWERS: You could do it.
7 MR. BUDNITZ: I don't know how.
8 MEMBER POWERS: If you said I have this
9 set of things that I hope that I want a PRA to do for
10 me. Then you could take your standard.
11 If Moses came down from the mountain and
12 said, "Here's what the PRAs are supposed to do for
13 you," and then you could set up your standard to say,
14 "Yeah, verily, a PRA meets this set of requirements,
15 would do these things."
16 MR. BUDNITZ: Well, no. Let me describe
17 where I think we're on different Riemann sheets, R-i-
18 e-m-a-n-n.
19 There is not a detailed treatment in our
20 standard of requirements for analyzing slumping
21 adjacent to the site after an earth quake. It was the
22 judgment of everybody that looked at the standard and
23 looked at practice and looked at sites that that's not
24 an issue of importance in nuclear power plants.
25 But that's inductive, not deductive.

1 MEMBER POWERS: At the sites we have.

2 MR. BUDNITZ: At the sites we have. Now,

3 there is an "other," right? There is a catch-all. Do

4 you know what I mean? You've got to have that.

5 If somebody came up with a site where that

6 was important, our standard wouldn't cover them.

7 Okay. You know?

8 I mean, so in that sense and at that level

9 you couldn't cover everything without making it not

10 just too much work and too much plow-through, but

11 unusable. So we had to make judgments about what's

12 important at the plants and with the PRAs and with the

13 systems and the structures and the operators and the

14 control rooms and stuff. They're out there for our

15 plants.

16 And that's what I mean by saying that it

17 is intrinsically inductive because there's -- by the

18 way, for seismic alone there are 600 issues like that.

19 Let me just get down to microstructure. Slumping

20 alone, 44 different kinds of slumping. I don't know

21 for all I know.

22 So that's a problem, and I don't know what

23 to do about it.

24 MEMBER ROSEN: Now, let's not be too

25 negative. Let me say a piece here.

1 MR. BUDNITZ: I'm not worried about being
2 negative.
3 MEMBER ROSEN: Some time ago there was
4 this feeling abound in the industry that PRA is no
5 good because we have no standards against which to do
6 them. Everybody does them differently, however they
7 want, and they're not reviewed by the Nuclear
8 Regulatory Commission. So who can use PRA?
9 Well, the problem with that is we've got
10 missions, policy statements; risk informed regulation
11 is a fact, and it's fundamentally on PRA, based on
12 PRA.
13 So the industry -- I say that broadly
14 because the staff was involved -- set out to build
15 some standards, and a peer review process melded up
16 with it, which actually predated their standards
17 effort, but the BWR owners groups' peer certification
18 process melded up with the standards, and now we have
19 an ASME standard for internal events. We've got an
20 ANS standard of external events. We've got a fire PRA
21 standard, et cetera. We've got a low per hour and
22 shutdown standard coming. We have standards.
23 Moreover, we have peer reviews which are
24 reported to be very effective. As a matter of fact,
25 I vouch for that, having been at a plant which had a

1 peer review, first class plant in terms of its PRA,
2 South Texas, which had a peer review and found out
3 that it had a ton of things to improve.
4 This is not a bad thing. This is a good
5 thing because they're out improving it. The best one
6 in the industry is being dramatically improved.
7 Is that bad? No, of course not. That's
8 good.
9 So that's where we find ourselves. You
10 want to be apologetic about external event standards?
11 Not you, but others. I am not apologetic. I think
12 it's a good shot. We need standards across the board,
13 and we're building them, and then we'll have
14 experience with it through the peer certification
15 process and through the use of a standards, and we'll
16 improve them.
17 This is all good.
18 CHAIRMAN APOSTOLAKIS: Well, I think a key
19 question related to this is how is a standard
20 constraining me. Can someone come here to the NRC and
21 say, "Oh, you have no right saying this because we
22 complied with the standard," or is a standard a means
23 of making sure that people meet certain minimum
24 requirements, that they know what to expect and they
25 do it? They will not come and say, "Well, gee, I met

1 the standard. Leave me alone."

2 MR. BUDNITZ: It's neither of those.

3 CHAIRMAN APOSTOLAKIS: What is it?

4 MR. BUDNITZ: First of all, it's a

5 voluntary standard. If you don't comply with the

6 standard, if you don't even pick it off the page and

7 never look at it, you can come to the NRC with

8 anything you want, and they will review your

9 submission and do what they want with it.

10 CHAIRMAN APOSTOLAKIS: Fine.

11 MR. BUDNITZ: So it's a voluntary

12 standard. So in that sense it doesn't constrain

13 anything.

14 Secondly, if you say, "I met the

15 standard," that doesn't constrain the NRC from saying,

16 "But even though you met Requirement 37" -- I'm just

17 pretending -- "we don't think that's enough to support

18 this application that you have. You've got to go do

19 more."

20 CHAIRMAN APOSTOLAKIS: So what is the --

21 MR. BUDNITZ: So in neither sense is it --

22 CHAIRMAN APOSTOLAKIS: So what is the

23 value of this standard?

24 MR. BUDNITZ: Well, the value of the

25 standard is that if you say you meet the standard, the

1 NRC may find itself able to review only very small
2 pieces of the standard for giving an applicant --
3 CHAIRMAN APOSTOLAKIS: So it's --
4 MR. BUDNITZ: -- for giving an application
5 and let the others go by because you met it.
6 CHAIRMAN APOSTOLAKIS: So it's the first
7 interpretation I gave you, that you come in here and
8 you have met the standard. That tells me that there
9 is a minimum level of quality already there, that I
10 shouldn't worry about you missing something important
11 because the standard says that it should be there.
12 Internal events, if you --
13 MR. BUDNITZ: Fair comment.
14 CHAIRMAN APOSTOLAKIS: Well, I'm not going
15 to worry about you missing common cause failures, for
16 heaven's sakes. I know that you have it there, but
17 you see, in that sense, it's a very good thing.
18 MEMBER ROSEN: Here's another good think
19 about a standard, and I think it's essential. I'm a
20 chemical engineer at heart, and chemical --
21 CHAIRMAN APOSTOLAKIS: You were 40 years
22 ago.
23 MEMBER ROSEN: Well, okay. A degree in
24 chemical engineering from a reputable, used to be
25 reputable university.

1 MEMBER KRESS: Once a chemical engineer,
2 always a chemical engineer.
3 MEMBER ROSEN: Chemical engineers have
4 standards. Chemists have standards. Physicists have
5 --
6 CHAIRMAN APOSTOLAKIS: There are
7 standards.
8 MEMBER ROSEN: -- Physicists have -- there
9 are physics standards. There are standards for all of
10 the disciplines. The ASME, the American Society of
11 Mechanical Engineers --
12 CHAIRMAN APOSTOLAKIS: Right.
13 MEMBER ROSEN: -- have standards for
14 mechanical engineering.
15 Why is that PRA, the only technical
16 discipline on this planet that doesn't have standards?
17 It's nonsense.
18 And so I know, you'll have an answer to
19 that question which I won't admire, but --
20 CHAIRMAN APOSTOLAKIS: He's a chemist.
21 That's worse.
22 MEMBER ROSEN: My point is that PRA is a
23 discipline just like any other engineering discipline.
24 It ought to have standards, and we're working on them.
25 CHAIRMAN APOSTOLAKIS: It's not like any

1 other engineering --

2 MEMBER KRESS: No, it's not.

3 CHAIRMAN APOSTOLAKIS: I think Dana was

4 right in the beginning. I mean, this is different.

5 This sets a framework perhaps where the elements are

6 there and so, but it doesn't tell you do it this way

7 and do it that way.

8 MR. BUDNITZ: George, I think I have a

9 better answer. Look. I can tell you standing here on

10 my two feet that as of a couple of years ago or three

11 when we started this effort, no more than have of the

12 seismic PRAs out there amongst half of the plants that

13 did them could have come close to meeting this

14 standard. About half of them were good, and the other

15 half weren't all that good at all.

16 Now, since we got this work going, they

17 have on their own -- standards aren't out yet -- most

18 of them have gone out and upgraded because they want

19 to meet it, and that's terrific.

20 All right. Now, the standard then becomes

21 a pull up, and that by itself is a tremendous

22 positive.

23 Now, I can say something about margins,

24 too. The seismic margin method had specific rules you

25 had to meet that EPRI published. You know, there's 47

1 of them or something like that.

2 Our standard just parroted them back.

3 Most of the margin reviews did better because it was

4 specific. I'm like, you know, there were things you

5 had to do, and they did them.

6 But some of them, although they thought

7 they didn't do all that well, they're upgrading, too.

8 So a principal benefit of a standard like this in the

9 ASME standard is -- and Steve said it, too -- is it

10 provides a bar that you can aspire to if you desire

11 to.

12 Now, you may find you only come up a

13 certain way and you're happy. And then an application

14 comes along where what you've got isn't enough.

15 You've got to do more.

16 The standard can tell you how to do more.

17 Maybe you've got a category capability, too in, let's

18 say, HRA, but for the problem you've got in front of

19 you, you've got to do better.

20 This tells you what a Category 3 is, and

21 so it enables you to know what 11 things, let's say,

22 need to be improved to provide the greater capability

23 that you need for your thing, for whatever your

24 problem is.

25 So it's structured and it has been

1 reasoned through by a committee of experts. The HRA
2 people wrote the HRA section in the ASME standard.
3 The fragilities people wrote the fragilities section
4 of our standard. The hazards people wrote the hazards
5 section. So you know it has a certain -- I think
6 that's a tremendous value quite separate from its use
7 in regulation.
8 You just are producing something that
9 people can use for self-improvement.
10 MEMBER POWERS: Let me ask a couple of
11 questions. There's what seems to me to be a certain
12 schizophrenia in the standard when you're discussing
13 the seismic input to the PRA. It's a characterization
14 of the site.
15 You used the words put in here "state of
16 the art" or "state of knowledge information" on
17 faults, ground motions, things like that.
18 And of course, I say, ah, that means to me
19 that what I'm going to do is I want to build my plant
20 on the least characterized site I possibly can because
21 then I have less information to put in.
22 You don't have anything absolute that says
23 --
24 MR. BUDNITZ: That's fair.
25 MEMBER POWERS: -- thou must know this

1 much about your site. You just say, "Here. Put in
2 what's the best information that's known."
3 Then you come along and you're discussing
4 -- you're into your discussion of uncertainties, and
5 you say, "Look. In addressing uncertainties in human
6 action you must address errors of omission, which
7 seems reasonable. It's just that I don't know how to
8 do it.
9 MR. BUDNITZ: Okay.
10 MEMBER POWERS: Okay? So here on the one
11 hand, you're saying, "What have you got that's good
12 enough?" and in another place you're saying you've got
13 to go not only where the rule is, but you'd better go
14 do something that I don't know how to do.
15 MEMBER ROSEN: You've got to if you want
16 to meet that paragraph of the standard.
17 MEMBER POWERS: Well, it turns out it
18 applies to the lowest category. Okay. Both of them
19 apply to the lowest category and consequently they
20 apply to all of the highest ones, too.
21 MR. BUDNITZ: Well, I understand your
22 dilemma, and I think you're right. Let me describe
23 what was in our mind. If you have a site on which
24 you're -- let's just pretend you have an operating
25 nuclear power plant on a site that's never been

1 characterized as opposed to a site that's never been
2 characterized and you're just about to design one.
3 By the way, you can use this for a plant
4 under design, too, as you know.
5 Then you would know rather little about
6 the seismic hazard and, therefore, rather little about
7 the seismic PRA. But the analysts could do the best
8 job he could with the data, and that's all we are.
9 It's not the analysts' fault that somebody
10 didn't dig holes, trenches and measure geophysics. So
11 the analyst would have a quality PRA, but when he went
12 to use it, the uncertainties would be so large he
13 couldn't use it for anything.
14 So in that sense you're right, but of
15 course, we had in mind there's no such thing as a
16 nuclear power plant who hasn't had a characterized
17 site following Appendix A, Part 100. We know that.
18 And so we have that in our mind and, I
19 think, correctly so, which goes into gory detail, as
20 I'm sure you -- if you don't know, I can tell you.
21 MEMBER POWERS: Yeah, I know.
22 MR. BUDNITZ: But what you have to do in
23 order to characterize your site. So we had that in
24 the back of our mind, but if you hadn't done that, you
25 could do your PRA. It would be a great PRA. It would

1 be like this, huge.

2 Nothing wrong with a great PRA with huge

3 uncertainties. The analysts did a wonderful job.

4 MEMBER POWERS: Well, I think you need to

5 put a footnote on that input. It's a --

6 MR. BUDNITZ: That's an interesting point.

7 MEMBER POWERS: You know, this is

8 predicated on our understanding that there are no

9 sites out there that have not had some minimal level

10 of characterization. Okay? And that if you should

11 happen to apply this to a site that's not had some

12 minimal level of characterization, you risk having

13 huge uncertainties.

14 MR. BUDNITZ: Well, yeah, yeah, but let me

15 explain why that footnote would then have to be

16 everywhere. Let's suppose I have a PRA, internal

17 events PRA. It could be a seismic PRA, but whose core

18 damage frequency depends on the reliability on demand

19 of a valve that's open that has to close to be safe.

20 It's open. You've got to close it to get a safe

21 shutdown.

22 And you want to ask the question: what's

23 the probability I can close that valve on demand, you

24 know, when I ask them to?

25 And we all know that the numbers for those

1 things are understood, ten to the minus three, you
2 know, whatever it happened to be.
3 But let's suppose somebody had a valve for
4 which he had no data, no data at all. Quite different
5 from any other valve. He actually couldn't do the
6 PRA, couldn't do it, absolutely couldn't do it.
7 I wouldn't throw mine at the analyst, nor
8 do I think I need a footnote in the section. I'll
9 leave you with that.
10 There is no such thing as a valve for
11 which there's no data, and there's no such thing as a
12 site for which there's no characterization, and
13 there's no such thing as a human action for which we
14 have no knowledge whatsoever.
15 There's always some knowledge, and we just
16 approach it that way. So, therefore, while I
17 understand why you would want to footnote, I insist
18 that you have to put a footnote in every single
19 requirement throughout this and the ASME standard, and
20 that then becomes a self-fulfilling prophesy towards
21 confusion.
22 Any comment?
23 CHAIRMAN APOSTOLAKIS: Now, judging from
24 the discussion --
25 MR. BUDNITZ: Go ahead. I'm sorry.

1 CHAIRMAN APOSTOLAKIS: Oh, I'm sorry.
2 You're through?
3 MR. BUDNITZ: No, I was done with that
4 unless you have --
5 MEMBER POWERS: I want to chase this a
6 little more. You tell me on the right hand that,
7 first of all, you say don't blame the analyst because
8 the site hasn't been characterized. I'm not using the
9 standard to evaluate analysts.
10 I'm using --
11 MR. BUDNITZ: Well, you're using it to
12 evaluate the analysis.
13 MEMBER POWERS: I'm using this to evaluate
14 site, the facilities, installations. And so you've
15 come in and you've gotten a wonderful PRA with lousy
16 input, and it's come in with the imprimatur that it
17 complies with the standard, and I say I've got limited
18 amounts of time to spend on review. Surely they've
19 done a wonderful job on the inputs because that
20 constitutes a huge amount of this standard, and it
21 calls out two other standards which sooner or later
22 will get published. That must be good. I'm going to
23 go look at that.
24 In fact, that's an Achilles heel. This is
25 coming in with an imprimatur that it may not deserve.

1 MR. BUDNITZ: You're completely correct.
2 MEMBER POWERS: The next thing I --
3 MR. BUDNITZ: You're completely correct.
4 MEMBER POWERS: -- I take you to -- that
5 I have trouble with is coming back to this errors of
6 commission. You say anything in here has been done by
7 somebody, and I'm sure there is somebody out there
8 that has addressed errors of commission.
9 But it hasn't achieved the level of
10 acceptance that it seems to me to deserve to go into
11 the standard.
12 MR. BUDNITZ: Well, in the HRA section,
13 human reliability analysis section, we, in fact, refer
14 by reference directly to the ASME standard, which has
15 a whole chapter on that, and don't deal with it at all
16 except that way.
17 And by the way, that's not only common
18 sense. It was a matter of policy.
19 So if you want to deal with that, you have
20 to go to the ASME standard. The ASME standard, the
21 committee, three or four of them struggled with that
22 for a year or two, did the best they could, and
23 actually have some requirements in there for errors of
24 omission and commission separately, and they own up to
25 the difficulties therein, thereby owning up to the

1 observation that there will be larger uncertainties
2 and less robust applications you can use.
3 But that is what it is.
4 MEMBER POWERS: Well, I would ask if
5 you're doing any rewriting to go and look at the words
6 you have there. Make sure you're communicating well
7 with the --
8 MR. BUDNITZ: Thank you.
9 I'd actually -- that's a good suggestion,
10 and it's not too late. If you have any specific place
11 -- you're talking about in the errors of commission
12 part?
13 MEMBER POWERS: Yeah, yeah.
14 MR. BUDNITZ: I can't remember where it
15 is, but I'll find it.
16 MEMBER POWERS: Let's see. If you look on
17 page 76, Note SA-B2.
18 MR. BUDNITZ: I'll just make a note of
19 that.
20 MEMBER POWERS: And just look to make sure
21 you've communicated well with everyone.
22 MR. BUDNITZ: Thank you. That's useful.
23 MEMBER POWERS: I've taken up a lot of
24 time here. I know there's --
25 MR. BUDNITZ: No, that's a fair -- that's

1 a fair comment.

2 MEMBER POWERS: Other members wish to

3 interrogate Mr. Budnitz?

4 CHAIRMAN APOSTOLAKIS: Just to close the

5 earlier discussion about the value of the standard,

6 the way I understand what Bob and Steve said, there is

7 no down side to having the standard, is there?

8 MR. BUDNITZ: Yes.

9 CHAIRMAN APOSTOLAKIS: Like what?

10 MR. BUDNITZ: Of course there is.

11 CHAIRMAN APOSTOLAKIS: What?

12 MR. BUDNITZ: the down side would be if

13 someone claimed that their analysis met the standard,

14 but it actually didn't because they neither did a

15 through review with a standard, nor did the peer

16 review do it right.

17 CHAIRMAN APOSTOLAKIS: But I have the

18 right to review it myself.

19 MEMBER ROSEN: That's not a down side,

20 Bob.

21 CHAIRMAN APOSTOLAKIS: That's not a down

22 side.

23 MEMBER ROSEN: Because that would have to

24 assume that the peer review failed open.

25 CHAIRMAN APOSTOLAKIS: That's right.

1 MEMBER ROSEN: Because what we ask here --

2 MR. BUDNITZ: Fair enough.

3 MEMBER ROSEN: -- what I intend to ask and

4 what I've always been intending to ask when someone

5 comes in with a risk informed application that they

6 want to prove and the staff has said, "Yeah, okay.

7 You can go talk to ACRS about it," is to say to them,

8 "Has your PRA been peer reviewed?"

9 "Oh, yes."

10 "Then tell me what the facts and

11 observations have been and what the important ones are

12 and what you've done about them.

13 So there's basically a line of questioning

14 that gets them to understand that we want

15 improvements. We want this --

16 MR. BUDNITZ: But even if --

17 MEMBER ROSEN: We want the peer review and

18 the standards taken seriously --

19 MR. BUDNITZ: That's a fair comment.

20 MEMBER ROSEN: -- and we want them

21 improved.

22 MR. BUDNITZ: That's a fair comment,

23 but --

24 CHAIRMAN APOSTOLAKIS: As long as you tell

25 me that I am not constrained by the decision making

1 process by the fact that somebody claims that they met
2 the standard, I don't see any down side.
3 MR. BUDNITZ: But, Steve, I'm going to --
4 CHAIRMAN APOSTOLAKIS: Only good things
5 can come out of it.
6 MR. BUDNITZ: I'm going to give you a down
7 side from my experience. The IPEEE, the individual
8 plant evaluation for external events and NUREG 1553
9 had in it a requirement that the IPEEEs be peer
10 reviewed All right?
11 Now, I was a peer reviewer for several of
12 them. Okay? That is, the utility would hire me to do
13 a peer review. And I can tell you that several of
14 those peer reviews were very thorough and useful. I
15 participated, and there was back and forth and, you
16 know, things to do and people listened.
17 And I can also tell you that several of
18 them were in which I would write a peer review and
19 nobody paid any attention, and I went back to them,
20 and they said, "We're submitting it anyway," and
21 that's a problem.
22 And I don't know what to do about that.
23 That's a problem.
24 MEMBER ROSEN: That may have happened. I
25 grant that, and I --

1 MR. BUDNITZ: It happened to me.

2 MEMBER ROSEN: Yeah. I'm saying that can

3 happen. I think the world is changing, and we are

4 moving forward.

5 MR. BUDNITZ: Thank God.

6 MEMBER ROSEN: And we happen to have a

7 consultant, not you; the ACRS has a consultant working

8 on issues of PRA, and he has spoken quite favorably

9 about the PRA review process.

10 CHAIRMAN APOSTOLAKIS: Oh, I think

11 everybody is for it.

12 MR. BUDNITZ: Oh, it's wonderful now,

13 yeah.

14 MEMBER ROSEN: And so the fact that in the

15 past there have been problems with it --

16 MEMBER POWERS: Recognize --

17 MEMBER ROSEN: -- but I don't think it's

18 dispositive.

19 MEMBER POWERS: -- there's at least one

20 dubious member of the committee.

21 MEMBER ROSEN: You may be dubious on peer

22 review, and I have said to you on the record in public

23 that what you ought to do about your dubiosity level

24 is to go out with a peer review team and take another

25 HCR staff with you, another one because we already

1 sent one, Mike Markley.

2 And you will find out, I think --

3 MR. BUDNITZ: Sent there for a week.

4 MEMBER ROSEN: Yeah. I think you will

5 find out that it is not the -- and it won't be the

6 Hawthorn effect doing it. It will be the fact that

7 the process is robust. It's going to strain even a

8 good site's PRA team and PRA. It will be robust and

9 it will be critical, and I think it will be responded

10 to.

11 MR. BUDNITZ: Yeah.

12 MEMBER ROSEN: Over time, not immediately.

13 It just goes on a corrective action. It goes in the

14 corrective action system, and it gets corrected.

15 MR. BUDNITZ: I don't think the interview

16 approach in this standard is a problem at all. I just

17 want to say that. I really think what we wrote was --

18 the requirements for it -- it followed correctly, and

19 by the way, what ASME did, too --

20 MEMBER ROSEN: Right.

21 MR. BUDNITZ: -- should produce a very

22 high quality peer review each time.

23 I mean, I think you don't know, you know,

24 but the requirements I think are very good.

25 CHAIRMAN APOSTOLAKIS: What's going on

1 with the IPEEEs now. A lot of them were done using
2 applied methodology for targets (phonetic) and the SMA
3 for seismic. Is there any move to do PRAs or we don't
4 know?
5 MR. BUDNITZ: I do know.
6 CHAIRMAN APOSTOLAKIS: What is going on?
7 MR. BUDNITZ: I don't know anything about
8 five. About half of the price at SMAs, seismic margin
9 assessments. Perhaps five or ten of them -- I'm not
10 quite sure what the count is because some of them, you
11 know, the same one applied to two plants -- are
12 operating through a PRA now.
13 MEMBER ROSEN: Isn't that a sweet thing?
14 MR. BUDNITZ: Huh?
15 MEMBER ROSEN: And isn't that a sweet
16 thing.
17 MR. BUDNITZ: That's good.
18 MEMBER ROSEN: That's part of the
19 consequences of what we're doing here.
20 MR. BUDNITZ: It is what it is.
21 MEMBER ROSEN: People see that what they
22 had before isn't serving them in the current
23 environment, and people are improving it. This is a
24 good thing, George, not a bad thing.
25 MR. BUDNITZ: Yeah, I think that's -- no,

1 I can't speak about five, but, by the way, you have to
2 be careful. Most of the plants use the screening part
3 of five, and then even if they did then the full PRA
4 on what they capped in, but some of the plants then
5 just use the screening part of five and then they use
6 the five for the analysis, and then they made a lot of
7 approximations, and I just can't speak to that.
8 MEMBER ROSEN: I don't think, to answer
9 your question directly -- it's just a thought; it's
10 just my own insight, my own opinion -- I don't think
11 there's a down side to this. I think there's a lot of
12 --
13 CHAIRMAN APOSTOLAKIS: That was my
14 conclusion from what you guys were saying.
15 MEMBER ROSEN: There's a lot of up sides
16 to having standards. They're not perfect now, and
17 smart people can point to things that are wrong with
18 them, and should, and the standards committees will
19 take that under advisement and over time they'll be
20 improved.
21 Has the IAEA done anything like this?
22 CHAIRMAN APOSTOLAKIS: I think they had
23 one for internal events, but not --
24 MR. BUDNITZ: Yeah, but it's not like
25 this.

1 By the way, I have a comment to make which
2 I think if you don't know about it, it will illuminate
3 you. The ASME committee on which I sit, you know, the
4 ASME committee that worked on the PRA standard, is
5 right now in the process of developing modifications
6 to some of the requirements based on feedback they've
7 gotten from both the NRC and the industry which would
8 result, once the process is done in perhaps a year, in
9 a revision to the standard that will improve it in
10 areas where either in the first round or in its use
11 various requirements have caused confusion or perhaps
12 they're not complete enough or perhaps there's a
13 suggestion how to improve it.
14 And that thing -- I don't know if it's a
15 year away or not, but it's roughly -- is an example of
16 how in its first round -- it will happen to us, too --
17 people will use it and through using it prove the
18 standard, just what you want.
19 And we've made that commitment. Okay?
20 CHAIRMAN APOSTOLAKIS: Okay.
21 MEMBER POWERS: Steve, let me come back
22 and comment a little bit about peer review. I think
23 it's really not a comment on the quality of peer
24 review that's done with the PRA. It's a comment on
25 Peer review that is a method of assuring technical

1 quality.

2 And what I find, maybe a little

3 background. My current employer, I was asked what

4 methods were for assessing the quality of technical

5 work, and so I went off and looked at a whole bunch of

6 methods to do that. One of them was peer review.

7 And I looked at the literature of this,

8 and you find that people who have studied peer review

9 come back with things like peer review is excellent;

10 it can be used for just about anything. The problem

11 is it's irreproducible and quixotic.

12 MR. BUDNITZ: And?

13 MEMBER POWERS: Quixotic.

14 MEMBER KRESS: Oh, no.

15 MEMBER POWERS: And inherently the

16 difficulty is if I take the people on the right side

17 of the table and ask them to peer review a product and

18 I take the people on the left side and ask them to

19 review the same thing, I don't get the same result.

20 Okay?

21 MEMBER WALLIS: You need to take 59 peer

22 review groups.

23 (Laughter.)

24 MEMBER ROSEN: Yes, and we will.

25 MEMBER SHACK: And take the 95-95 --

1 MEMBER ROSEN: We will after 108 years or
2 something like that, 118 years.
3 MEMBER SHACK: Well, keep that in mind the
4 next time you remember we've got to send these codes
5 out for peer review.
6 MEMBER KRESS: Dana, if you were asking
7 the peer reviewers a simple question like is this PRA,
8 let's say, acceptable for this purpose, yes or no --
9 MEMBER ROSEN: That's not a simple
10 question. You've got to ask a very targeted question.
11 MEMBER KRESS: That's a pretty simple
12 question.
13 MEMBER ROSEN: You have to ask a simpler
14 one than that.
15 MEMBER POWERS: Most of the studies --
16 MEMBER KRESS: You're unlikely to get the
17 same answer from --
18 MEMBER POWERS: Most of the academic
19 studies on peer review look at, choose as their object
20 of study situations that are very, very simple. Is
21 this proposed piece of work meriting funding?
22 Okay. That's a pretty straightforward
23 question.
24 MR. BUDNITZ: Or publication.
25 MEMBER POWERS: Or publication, but most

1 of them it turns out where they've gone off and
2 they've studied it, you know, they've given multiple
3 committees never 59, Graham, but three have been done.
4 And what they find, by the way -- I mean,
5 some of this stuff is just fascinating -- is I take
6 those three guys and they're my peer review team, and
7 I send everything to them consistently, I get a
8 consistent result, internally consistent result, that
9 is, if they funded Project A and did not fund Project
10 B, when I put in A prime, they'll fund it, and when I
11 put in B prime, they will not fund it.
12 MEMBER WALLIS: I think we're talking
13 about reviewing proposals. This is a very different
14 business from reviewing something that is essentially
15 state of the art. You'd expect there would be much
16 more uniformity in the quality expected from an
17 engineering job than there would be in whether or not
18 you should fund some strange idea which might appeal
19 to somebody and not appeal to somebody else.
20 It seems to me it's a different world,
21 isn't it?
22 MEMBER POWERS: You could be correct. You
23 could be correct. I can only quote to you, you know,
24 what I know, I mean, what I've read about, this
25 problem of quixoticness. But similarly, if I send A

1 and B over to this group of people, they'll fund B
2 instead of A.
3 MR. BUDNITZ: Oh, but -- but-- but it's
4 very important to recognize that peer review is
5 limited by the state of the art of the community. I
6 know a story about that, as probably most people in
7 the room know.
8 There was a classic engineering mistake
9 made in a bridge in the State of Washington in the
10 '30s, I think it was, the Tacoma Narrows Bridge. That
11 bridge was designed by a firm that was competent and
12 thought to be at the time and peer reviewed by others.
13 But the state of the art somehow missed
14 that failure mode which then bit them in the first
15 year and it collapsed.
16 Now, there's no way that we can achieve
17 perfection here, but what we're doing is we're trying
18 to have assurance.
19 MEMBER POWERS: No, all I'm trying to do
20 is achieve consistency.
21 MR. BUDNITZ: Well, I don't know what you
22 mean by consistency. The fact is that when something
23 is on the borderline --
24 MEMBER POWERS: Reproducibility.
25 MR. BUDNITZ: When something is on the

1 borderline, some people will make different judgments,
2 but something that is obviously okay will be found, I
3 think, by most people to be obviously --
4 MEMBER POWERS: You're going to go off and
5 join and have gone off and have joined an organization
6 that I think suffers this problem. They will say,
7 "Okay, you people that have nuclear waste material.
8 You've got this place you're going to put this nuclear
9 waste. Do a performance assessment."
10 They do so and submit it to DOE. DOE has
11 some people review it. They say, "Well, this
12 performance assessment is fine, except you have to
13 correct the following things."
14 It's sent back to the people. They
15 correct those things. They submit it to DOE. DOE
16 assembles another peer review panel. They review it,
17 and they come up with another set. You're caught in
18 an "infinite do" loop.
19 And that's an example of the inherent
20 irreproducibility of peer review.
21 MR. BUDNITZ: All right, but that's only
22 if it's true. If they first time they found 66 things
23 wrong and the second time they found three, then
24 they're converging. If the first time they found 66
25 things wrong and the second time they found 166 things

1 wrong, then they are diverging.

2 And you haven't mentioned which you think

3 it is. It's my notion that the converging case is not

4 only the most common, but almost always the case.

5 I mean, sure, there are other kinds of

6 example. The Tacoma Narrows Bridge actually came

7 down, despite having met the code and peer review.

8 MEMBER POWERS: As long as you're over in

9 your organization, why don't you go look? Because I

10 think you will find that --

11 MR. BUDNITZ: My organization, meaning?

12 MEMBER POWERS: Department of Energy.

13 -- that you will find that the peer review

14 groups feel an obligation to find a roughly constant

15 number of faults with something.

16 CHAIRMAN APOSTOLAKIS: Well, you know,

17 it's the nature of PRA.

18 MEMBER WALLIS: Who else would you use?

19 Who else would you use to review?

20 MEMBER ROSEN: In my experience now, you

21 have six guys come onto the site. They stay there for

22 a couple of weeks, and they're all PRA people from

23 other utilities and maybe a consultant or two, but you

24 go down their curriculum vitae. Each one of them

25 you'd say, "I'd hire that guy as a PRA guy. I'd hire

1 that guy as a PRA guy."

2 These are good people, and then they come

3 and give you a list of things to do, and you say, "Oh,

4 my God, that's a long list. I want to see if this

5 stuff is really bad in our PRA."

6 And you look at your PRA and you say,

7 "Yeah, that's not so good, and here's the standard,

8 and here's the peer review thing."

9 We need to fix that, George. So you send

10 some guy over -- excuse me, George -- but you send

11 him off to fix it, and then let's say two years hence

12 if I was still there they'd send another team of six

13 different guys back in, and they are quixotic, too,

14 and they give me another list of facts and

15 observations just as long as the prior one, and it

16 doesn't include any of the other ones because the ones

17 I found before have all been fixed, but they're also

18 a whole new set, and they're also good things.

19 Am I ahead or am I behind? It wasn't

20 reproducible. That's for sure, but I'm ahead, I think

21 if I just found some more problems, and one of the

22 things I know as a manager is I cannot fix problems I

23 don't know about, and any problem I know about I think

24 I can fix.

25 So when I'm told about a problem, I have

1 a whole new opportunity. So it's a good thing, not a
2 bad thing, but it not be reproducible.
3 MR. BUDNITZ: But, Steve, I actually
4 believe something different. Knowing the composition
5 of those things is like going around with these PRA
6 certifications to the plants. I find it unlikely or
7 almost inconceivable that a second group would find an
8 equally large number of things of comparable
9 importance because the depth and detail to which those
10 things are done is really very, very astounding to me.
11 I've been -- you know, I find it very --
12 MEMBER ROSEN: And to me. I verify or
13 validate.
14 MR. BUDNITZ: So I would -- while it's
15 possible, I don't think that scenario would play out.
16 It could.
17 MEMBER ROSEN: I agree with you, but I'm
18 just saying if it did play out, as I think Dana was
19 suggesting with the word "irreproducible," that would
20 be a good thing, not a bad thing. To me it's just a
21 whole other list of things that you can fix.
22 MR. BUDNITZ: But if there was 66 and
23 there was another 66, it would tell you that the first
24 team isn't doing their job, I mean, as opposed to 66
25 and there are seven more, you know, or something.

1 MEMBER ROSEN: Well, maybe, but I think,
2 you know, if there were 66 and the theme documented
3 that I found them and documented that many, they're at
4 exhaustion at that point.
5 MEMBER WALLIS: Well, you'd be concerned
6 if the second group reversed the recommendation.
7 MEMBER POWERS: Yeah, that too. The
8 irreproducibility is I send it to two teams at the
9 same time, and they come up with a difference, and
10 that could be the exhaustion feature.
11 Let me turn to another subject here.
12 MR. BUDNITZ: Sure. Talk about hazard.
13 MEMBER POWERS: It's a curiosity. Again,
14 I will emphasize that on my third reading of this, and
15 recognizing this level of resolution discriminator
16 among the categories which had much more impact on me
17 than anything else you said in this document, but I
18 may be alone in that, that I come down and I look at
19 some of the languages under these categories, and I
20 don't understand the distinctions and differences
21 you're drawing here.
22 Let's turn to page 63, HA-E1, and under
23 Category 1 --
24 MR. BUDNITZ: HA?
25 MEMBER POWERS: HA-E1. It's on page 63.

1 MR. BUDNITZ: Thank you.

2 MEMBER ROSEN: It takes me a minute to

3 thumb through here.

4 MEMBER POWERS: Okay. If we --

5 MR. BUDNITZ: My pagination is different

6 than yours. HA-E1. Go ahead.

7 MEMBER POWERS: E1. It says under

8 capability Category 1 -- this is an example. This

9 happened several times in here -- "demonstrate the

10 PSHA accounts for the effects of site topography,

11 surficial geologic deposits, and site geotechnical

12 properties."

13 Under Categories 2 and 3 instead of saying

14 "demonstrate accounts for," it says "account in the

15 PSHA for the effects of," and it's the same list of

16 things.

17 What is the distinction which you're

18 trying to do between account and demonstrate the

19 account?

20 MR. BUDNITZ: Damned if I know.

21 MEMBER POWERS: This happened several

22 times in this document.

23 MR. BUDNITZ: It may even happen several

24 times. That's one that must have got buy us. I don't

25 -- I've got to think about that. I don't see the

1 difference.

2 MEMBER POWERS: It looked to me --

3 MR. BUDNITZ: "Demonstrate that the PSHA

4 accounts for something."

5 MEMBER POWERS: And account for something.

6 In fact, Category 1 seems more stringent from the

7 Category 2.

8 MR. BUDNITZ: They look to be the same.

9 I plead guilty to that one. That one probably got by

10 us. Let me make a note and fix that one.

11 MEMBER WALLIS: This is a peer review

12 you're going through now.

13 MR. BUDNITZ: I don't mind it. We're

14 going to take improvements for the next ten minutes.

15 MEMBER POWERS: Similarly if you look at

16 HA-B3.

17 MR. BUDNITZ: B?

18 MEMBER POWERS: It says "as a part of the

19 database used include a catalogue of the historically

20 reported."

21 Two and three as part of the data

22 collection "compile a catalogue."

23 I struggle with understanding. I mean

24 they've clearly written down both.

25 MR. BUDNITZ: Oh, that's really --

1 MEMBER ROSEN: The words "include" and
2 "compile" mean something different than -- there's a
3 set of definitions up front, right?
4 MR. BUDNITZ: Well, actually "include" and
5 "compile," in the one case, you don't have to do any
6 work on your own. You just have to compile something
7 that was there already. Here you've got to do new
8 work.
9 MEMBER POWERS: If I could compile
10 something, to include it. I mean I --
11 MR. BUDNITZ: No, that's a clear
12 distinction.
13 MEMBER POWERS: Explain it to me again,
14 please.
15 MEMBER ROSEN: I'm wrong; I'm wrong. There is no
16 definition of "include" and "compile."
17 MR. BUDNITZ: These ones up front, no.
18 Well, capability Category 1 allows you to
19 use an existing database. Read it "as part of the
20 database used, include a catalogue."
21 Capability Category 2 and 3 require you to
22 collect new data. It's part of data collection, not
23 as part of a database used. It's really quite --
24 MEMBER POWERS: But I have to go out and
25 collect the database that I use.

1 MR. BUDNITZ: No, no.

2 MEMBER POWERS: That I included.

3 MR. BUDNITZ: No, you don't have to

4 collect new data in Category 1. You just use it.

5 MEMBER POWERS: Well, I just have to sit

6 there and think it up? I mean, I have to do something

7 to it.

8 MEMBER ROSEN: Well, it may be in your

9 FSAR. You don't have to do any new work. It's just

10 a matter of opening the book to the page.

11 MEMBER POWERS: Or maybe you want to look

12 and be sure that people understand the distinction

13 MEMBER ROSEN: Catalogue that historically

14 reported geologically identified earthquakes is

15 something that's going to be in your FSAR.

16 MEMBER POWERS: Compile a catalogue that

17 historically reported geologically identified -- man,

18 it's the same thing.

19 MEMBER ROSEN: I take your point.

20 MEMBER POWERS: It is exactly the same.

21 MEMBER ROSEN: I'm sure Bob does.

22 MR. BUDNITZ: Well, I see a distinction,

23 but it's not a big distinction.

24 MEMBER ROSEN: You can take that into

25 account as you move further towards completion of the

1 standard.

2 MEMBER POWERS: Do people have anymore

3 questions?

4 MR. BUDNITZ: There may be things like

5 that, and I'm not going to claim this thing is

6 perfect.

7 By the way, just to tell you, all right??

8 And this is not mea culpa at all. Of course, there

9 are going to be some stuff like that, and every one

10 that you call to our attention I will write down, and

11 we will account for it, not just these two or three

12 here, but anybody else, because it could easily be

13 that this will be confusing or the distinction isn't

14 important or whatever.

15 MEMBER POWERS: In general, I mean, again,

16 after I had read your words on the level of resolution

17 and understood them and taken them to heart, I said,

18 "Gee, I really don't need all of these separate

19 categories here. I understand what he's doing, man.

20 He's reminding me I can create PRAs of different

21 levels of resolution, and that's okay with him."

22 And the fact that your requirements were

23 the same under all three categories, that's fine.

24 That's wonderful, in fact. It's just on different

25 levels of resolution, and I became very happy with it.

1 MR. BUDNITZ: But I just want to insist.
2 I said this before. There are three reasons why
3 something can get to a higher capability: either a
4 different levels of resolution or realism versus
5 conservatism or plant specificity versus generic.
6 And any one of those makes it a higher
7 category, and it's not only resolution. Okay? And
8 I'm sure you understand. In seismic, for example, if
9 you have generic knowledge that certain compact valves
10 are five G valves, you can use that generic knowledge
11 without needing plant specific, you know. All right?
12 So there's a distinction about plant
13 specificity and about realism versus conservatism
14 which are distinct from resolution. Okay?
15 MEMBER POWERS: Okay. I hear you on that,
16 and it really hasn't come home to me as much as the
17 resolution issue, but I think you're right on that.
18 Also, having that, it's a two dimensional field that
19 you have, three dimensional field that you have for
20 deciding whether something is Category 1, Category 2,
21 Category 3, and I think you're probably right on that.
22 The one that just came home to me made it
23 all clear, made me quit quibbling with your words
24 under each category was the level of resolution, and
25 I became very happy at that point.

1 Do members have any other questions they
2 want to pose to Bob?
3 (No response.)
4 MEMBER POWERS: Bob, let me say that this
5 was a chore given to me by the Chairman I welcomed a
6 little bit like a trip to the dentist, but in the end
7 I saw that you had done a heroic job.
8 MR. BUDNITZ: Thank you.
9 MEMBER POWERS: And thoroughly enjoyed
10 reading the material. It is one of those documents I
11 will keep on my desk.
12 CHAIRMAN APOSTOLAKIS: But not your night
13 stand.
14 MEMBER POWERS: Not my night stand. I
15 give it back to you, Mr. Chairman.
16 CHAIRMAN APOSTOLAKIS: Thank you very
17 much.
18 MR. BUDNITZ: Can I just say that I'll be
19 thrilled when I can get it off of my desk.
20 (Laughter.)
21 MR. BUDNITZ: And I'm sure you understand.
22 CHAIRMAN APOSTOLAKIS: Any other comments
23 from anybody?
24 I guess not. Thank you, Bob, for coming.
25 MR. BUDNITZ: Thank you.

1 CHAIRMAN APOSTOLAKIS: This has been a
2 delightful exchange. I feel much better now that I
3 know that I'm not constrained by this.
4 Okay. We'll recess until ten minutes past
5 three, and are we ready to do the PNT?
6 PARTICIPANT: Yes.
7 CHAIRMAN APOSTOLAKIS: Okay. We don't
8 need transcription anymore because it's all internal.
9 (Whereupon, at 2:54 p.m., the Advisory
10 Committee meeting was adjourned.)
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CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Advisory Committee on Reactor Safeguards - 498th Meeting

Docket Number: (Not Applicable)

Location: Rockville, Maryland

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

/s/ Rebecca Davis

Rebecca Davis
Official Reporter
Neal R. Gross & Co., Inc.

MATRIX 1

SCOPE AND ASSOCIATED TECHNICAL REVIEW CRITERIA

Materials and Chemical Engineering

Areas of Review	Applicable to	Primary Review Branch	Secondary Review Branch(es)	SRP Section Number	Focus of SRP Usage	Other Guidance	Boilerplate Safety Evaluation Section Number		Acceptance Review
							BWR	PWR	
Reactor Vessel Material Surveillance Program	All EPUs	EMCB	SRXB	5.3.1 Draft Rev. 2 April 1996	GDC-14 GDC-31 10 CFR 50, App. H 10 CFR 50.60	RG 1.190	2.1.1	2.1.1	
Pressure-Temperature Limits	All EPUs	EMCB	SRXB	5.3.2 Draft Rev. 2 April 1996	GDC-14 GDC-31 10 CFR 50, App. G 10 CFR 50.60	RG 1.161 RG 1.190	2.1.2	2.1.2	
Pressurized Thermal Shock	All EPUs	EMCB	SRXB	5.3.2 Draft Rev. 2 April 1996	GDC-14 GDC-31 10 CFR 50.61	RG 1.161 RG 1.190		2.1.3	
Reactor Internal and Core Support Materials	All EPUs	EMCB		4.5.2 Draft Rev. 3 April 1996	GDC-1 10 CFR 50.55a	Note 1*	2.1.3	2.1.4	

Areas of Review	Applicable to	Primary Review Branch	Secondary Review Branch(es)	SRP Section Number	Focus of SRP Usage	Other Guidance	Boilerplate Safety Evaluation Section Number		Acceptance Review
							BWR	PWR	
Reactor Coolant Pressure Boundary Materials	All EPUs	EMCB	EMEB SRXB	5.2.3 Draft Rev. 3 April 1996	GDC-1 10 CFR 50.55a GDC-4 GDC-14 GDC-31 10 CFR 50, App. G	RG 1.190 GL 97-01 IN 00-17s1 BL 01-01 BL 02-01 BL 02-02 Note 2*	2.1.4	2.1.5	
				4.5.1 Draft Rev. 3 April 1996	GDC-1 10 CFR 50.55a GDC-14				
				5.2.4 Draft Rev. 2 April 1996	10 CFR 50.55a				
				5.3.1 Draft Rev. 2 April 1996	GDC-1 10 CFR 50.55a GDC-4 GDC-14 GDC-31 10 CFR 50, App. G				
				5.3.3 Draft Rev. 2 April 1996					
				6.1.1 Draft Rev. 2 April 1996					
Leak-Before-Break	All EPUs	EMCB		3.6.3 Draft Aug. 1987	GDC-4	NUREG 1061 Vol. 3 Nov. 1984		2.1.6	
Protective Coating Systems (Paints) - Organic Materials	All EPUs	EMCB		6.1.2 Draft Rev. 3 April 1996	10 CFR 50, App. B RG 1.54		2.1.5	2.1.7	

Areas of Review	Applicable to	Primary Review Branch	Secondary Review Branch(es)	SRP Section Number	Focus of SRP Usage	Other Guidance	Boilerplate Safety Evaluation Section Number		Acceptance Review
							BWR	PWR	
Effect of EPU on Flow-Accelerated Corrosion	All EPUs	EMCB				Note 3*	2.1.6	2.1.8	
Steam Generator Tube Inservice Inspection	PWR EPUs	EMCB		5.4.2.2 Draft Rev. 2 April 1996	10 CFR 50.55a	RG 1.121 GL 95-03 BL 88-02 GL 95-05 Note 4*		2.1.9	
Steam Generator Blowdown System	PWR EPUs	EMCB		10.4.8 Draft Rev. 3 April 1996	GDC-14			2.1.10	
Chemical and Volume Control System (Including Boron Recovery System)	PWR EPUs	EMCB	SPLB SRXB	9.3.4 Draft Rev. 3 April 1996	GDC-14 GDC-29			2.1.11	
Reactor Water Cleanup System	BWR EPUs	EMCB		5.4.8 Draft Rev. 3 April 1996	GDC-14 GDC-60 GDC-61		2.1.7		

Notes:

1. In addition to the SRP, guidance on neutron irradiation-related threshold for inspection for irradiation-assisted stress-corrosion cracking for BWRs is in BWRVIP-26 and for PWRs in BAW-2248 for E>1 MeV and in WCAP-14577 for E>0.1 MeV. For intergranular stress-corrosion cracking and stress-corrosion cracking in BWRs, review criteria and review guidance is contained in BWRVIP reports and associated staff safety evaluations. For thermal and neutron embrittlement of cast austenitic stainless steel, stress-corrosion cracking, and void swelling, applicants will need to provide plant-specific degradation management programs or participate in industry programs to investigate degradation effects and determine appropriate management programs.

2. For thermal aging of cast austenitic stainless steel, review guidance and criteria is contained in the May 19, 2000, letter from C. Grimes to D. Walters, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel Components."

3. Criteria and review guidance needed to review EPU applications in the area of flow-accelerated corrosion is contained in Electric Power Research Institute Report NSAC-202L-R2, April 1999, "Recommendations for Effective an Flow-Accelerated Corrosion Program."

4. Also see the plant-specific license amendments approving alternate repair criteria and redefining inspection boundaries.

LIST OF ACRONYMS FOR MATRIX 1

BL = bulletin
BWR = boiling-water reactor
CFR = *Code of Federal Regulations*
EMCB = Materials & Chemical Engineering Branch
EMEB = Mechanical & Civil Engineering Branch
EPUs = extended power uprates
GDC = General Design Criterion
GL = generic letter
PWR = pressurized-water reactor
RG = regulatory guide
SPLB = Plant Systems Branch
SRP = Standard Review Plan
SRXB = Reactor Systems Branch

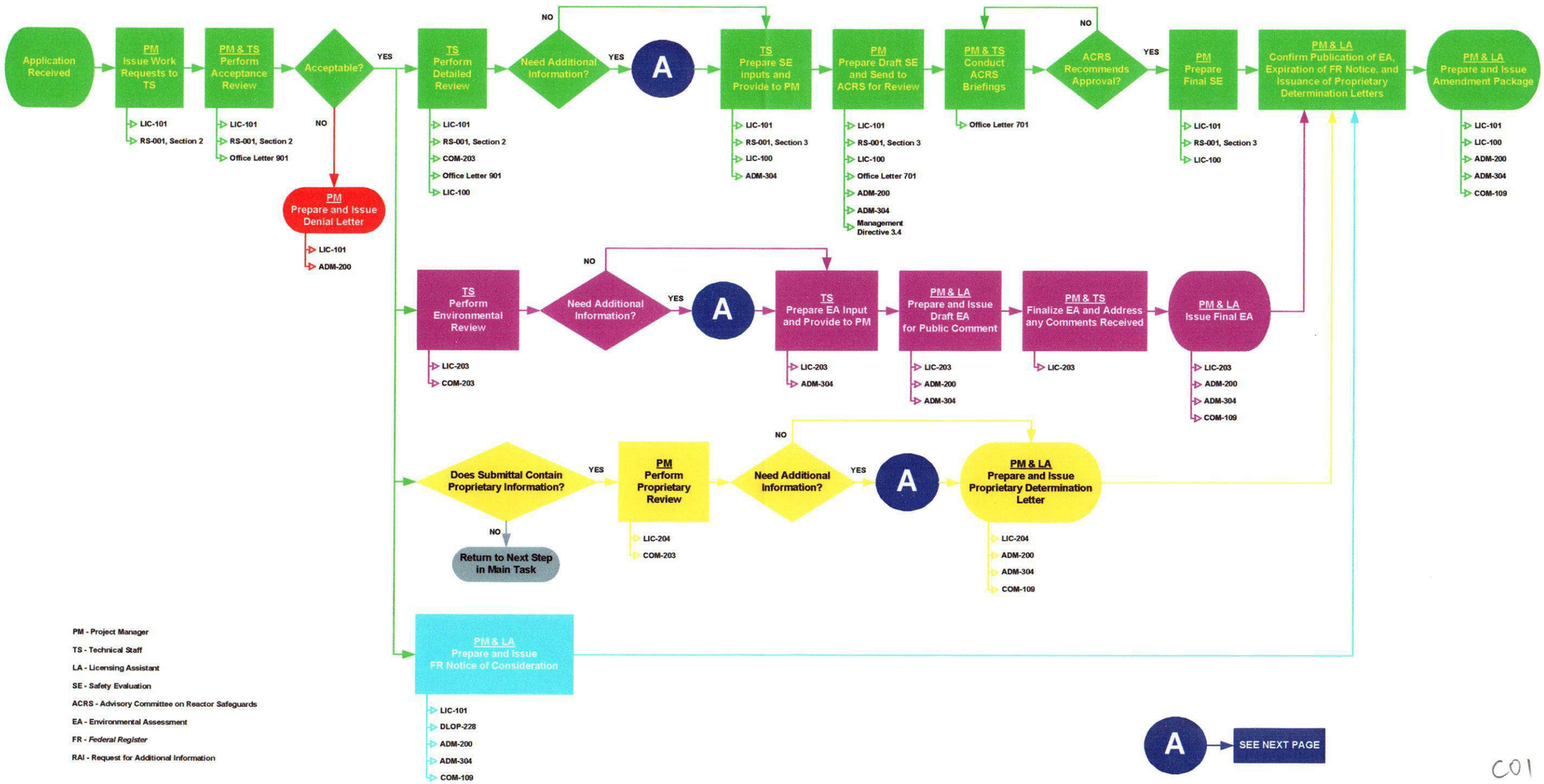
ATTACHMENT 1 TO MATRIX 1

Independent Calculations

Materials and Chemical Engineering

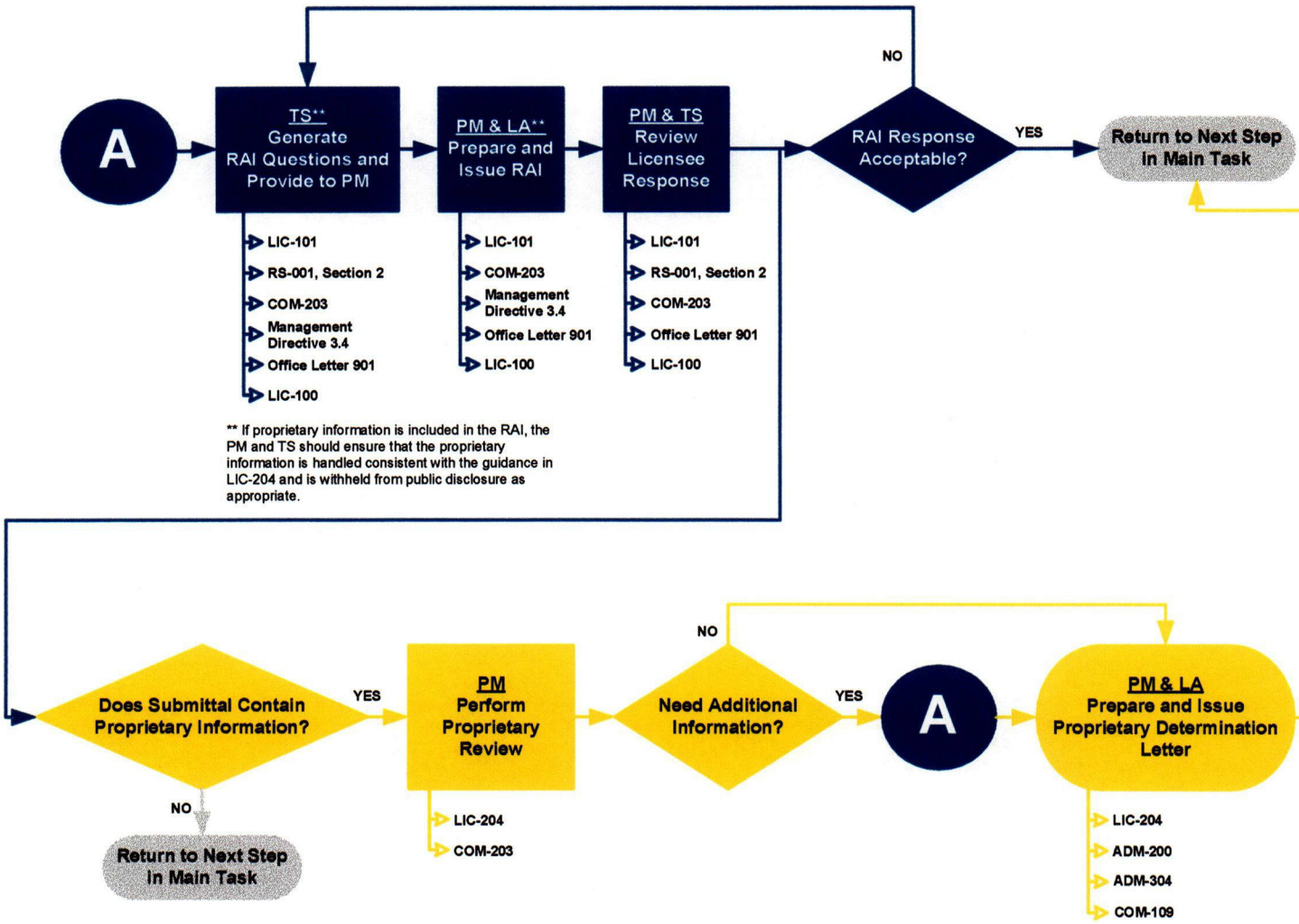
Perform independent calculations of the pressurized thermal shock reference temperature and upper-shelf energy (if there is a change in the evaluation of these quantities as a result of the proposed extended power uprate).

Figure 1.1-1 EPU Process Flow Chart



C01

Figure 1.1-1 EPU Process Flow Chart
continued



PM - Project Manager

TS - Technical Staff

LA - Licensing Assistant

SE - Safety Evaluation

ACRS - Advisory Committee on Reactor Safeguards

EA - Environmental Assessment

FR - *Federal Register*

RAI - Request for Additional Information

C02

POWER UPRATES

DEVELOPMENT OF REVIEW STANDARD FOR EXTENDED POWER UPRATES

ACRS 498th Meeting

December 5, 2002

- Background
- ACRS Feedback
- Review Standard
- Purpose of a Review Standard
- Development of the EPU Review Standard
- Discussion of the EPU Review Standard
- Schedule
- Conclusions

BACKGROUND

- Maine Yankee Lessons Learned
- Template Safety Evaluations
- SECY-01-0124, dated July 9, 2001
- Commission Meeting with ACRS, December 5, 2001
- ACRS Letters on EPU Reviews
- SECY-02-0106, dated June 14, 2002

ACRS FEEDBACK

- Documentation
- Reload Analyses
- Independent Calculations
- Anticipated Transients Without Scram
- Fuel
- Operator Action Times
- Material Degradation
- Containment Response
- Large Transient Testing
- Probabilistic Risk Assessment
- Communication with Inspection Staff

REVIEW STANDARD

- Clearer Definition of Review Scope
- Technical Review Criteria
- Process Guidance
- Boilerplate Safety Evaluations

PURPOSE OF A REVIEW STANDARD

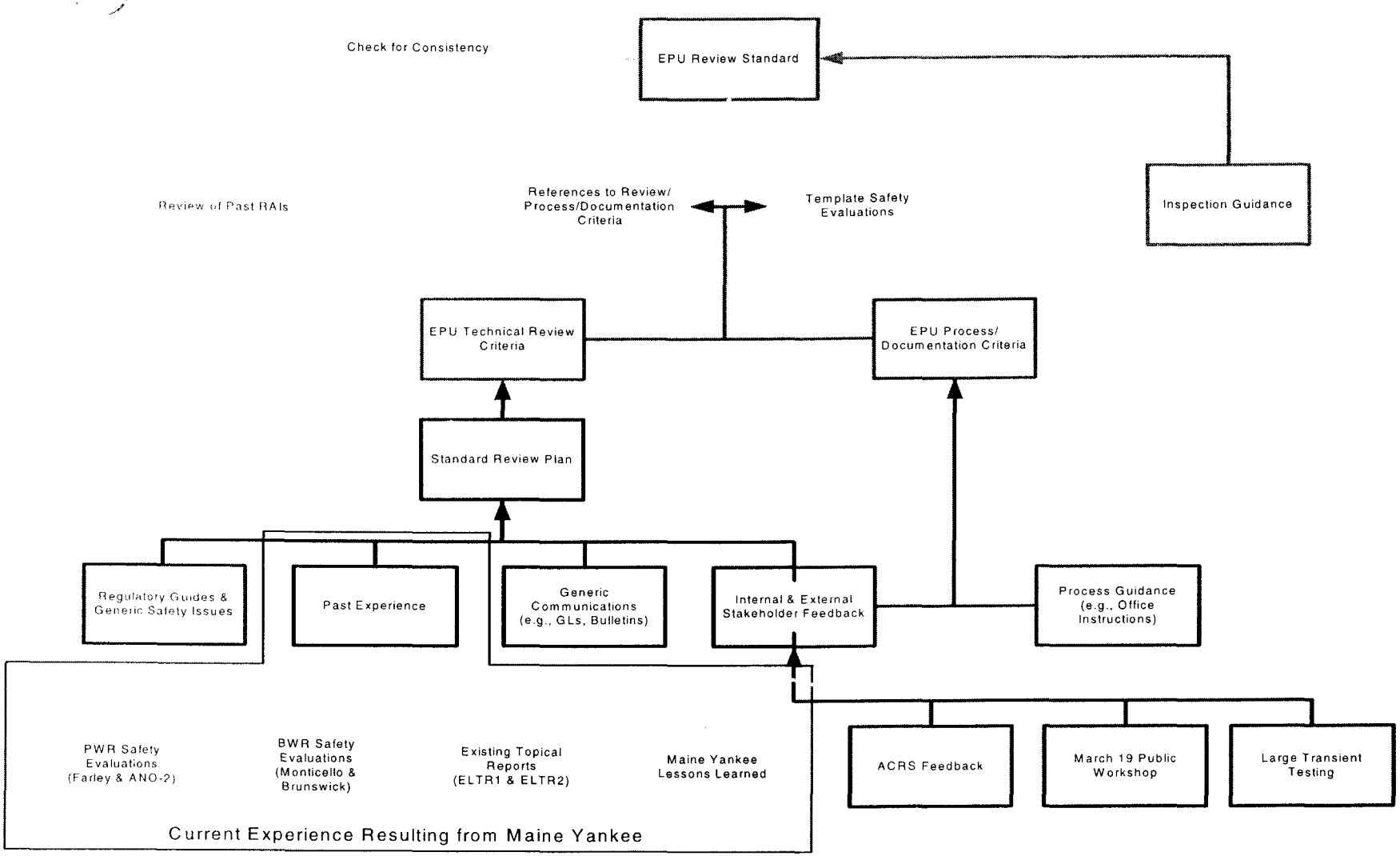
- Provide:
  - Comprehensive Guidance
  - Mechanism for Retention of Institutional Knowledge
  - Technical Review Criteria and Procedural Guidance
  - Updated Guidance

PURPOSE OF A REVIEW STANDARD

- Increase Effectiveness and Efficiency of Reviews by:
  - Implementing NRR's Vision for Centralized Work Planning
  - Improving Focus, Consistency, Completeness, and Thoroughness of Reviews
- Improve Documentation of Reviews

NRR
WORK PLANNING
CERTIFIED

Development of Extended Power Uprate Review Standard



REVIEW STANDARD FOR EXTENDED POWER UPRATES

Covers:
- *Technical Review*
- *Environmental Assessment*
- *Proprietary Review*
- *Noticing in Federal Register*

Provides Flowchart for Process

Identifies Procedural Guidance

SECTION 1
PROCEDURAL GUIDANCE

SECTION 2
TECHNICAL REVIEW GUIDANCE

SECTION 3
DOCUMENTATION OF REVIEW

SECTION 4
INSPECTION GUIDANCE

Areas of Review

Acceptance Review Checklist

Responsible NRR Review Branches

Guidance Documents

Guidance for Independent Analyses

SECTION 2
TECHNICAL REVIEW GUIDANCE

SECTION 3
DOCUMENTATION OF REVIEW

SECTION 4
INSPECTION GUIDANCE

Standardize Format and Content

Provide Regulatory Evaluation and Conclusion for Each Area of Review

Technical Evaluation Provided After Review

Consistent with NRR Guidance

SECTION 3
DOCUMENTATION OF REVIEW

SECTION 4
INSPECTION GUIDANCE

Inspection Procedure for Power Uprates

Documentation Highlights Recommended Areas for Inspection

SECTION 4
INSPECTION GUIDANCE

REVIEW STANDARD FOR EXTENDED POWER UPRATES

SCHEDULE

- Issue Review Standard for Interim Use and Public Comment – December 2002
- Brief ACRS on Results of Public Comment
- ACRS Review Following Public Comment
- Address Any Additional ACRS Comments
- Issue Final Review Standard – Early 2004

CONCLUSIONS

- The Staff is Near Completion of the Draft Review Standard for Extended Power Uprates
- Review Standard will Address ACRS Feedback
- Review Standard is Expected to Improve Effectiveness and Efficiency through Improved Focus, Consistency, Completeness, and Thoroughness of Reviews.
- Review Standard is Expected to Result in Better Documentation of Reviews.

Technical Related Policy Issues for Future Non-Light Water Reactors

Presentation to ACRS-Full Committee
December 6, 2002
T.L. King, NRC/RES
301-415-6345

Introduction

- SECY-02-0139, "Plan for Resolving Policy Issues Related to Licensing Non-Light Water Reactors Designs" identified seven issues with potential policy implications resulting from the preapplication reviews to date of the Pebble Bed Modular Reactor (PBMR)and the Gas Turbine-Modular Helium Reactor (GT-MHR):
  - Expectations for safety
  - Defense-in-depth
  - Use of International codes and standards
  - Event selection
  - Source term
  - Containment vs. Confinement
  - Emergency preparedness
- Scope of issues is reactor design and operation.
- Many of the issues are linked.

Introduction (Cont.)

- Four of the issues were presented to the Commission 10 years ago (SECY-93-092) and the Commission provided guidance in a Staff Requirements Memorandum (SRM of July 30, 1993).
  - appropriate to revisit these issues given the current emphasis on risk-informed regulation and the Commission's Strategic Plan
- Public workshop held October 22–23, 2002.
- Recommendations on their resolution are due to the Commission in late December 2002.
- Purpose of this briefing is to:
  - discuss the origin and background for each issue
  - discuss key questions associated with the issues
  - discuss options for their resolution
  - discuss feedback received at the public workshop
  - discuss draft staff recommendations
  - solicit letter from ACRS on draft recommendations

Evaluation of Issues

In assessing the options and developing the recommendations on the seven issues the following general guidelines are proposed:

- **The risk to the population around a nuclear power plant site should be consistent with the Commission's Safety Goal Policy.**
- **A risk-informed and performance based approach should be chosen, wherever practical.**
- **A technology neutral approach should be used.**
- **The Commission's Strategic Plan (NUREG-1614) performance goals of maintaining safety; enhancing public confidence; efficiency, effectiveness and realism; and reducing unnecessary burden should be used to assess the advantages and disadvantages of the options and develop recommendations.**
- **Consideration of previous Commission guidance (July 30, 1993, SRM).**
- **Practicality.**

Expectations for Enhanced Safety

- Issue: How to implement the Commission's expectations for enhanced safety:
  - 1985 Severe Accident Policy Statement (new plants are to achieve a higher standard of severe accident safety performance than prior designs)
  - 1986 Advanced Reactor Policy Statement (as a minimum, the same degree of protection that is required for current generation LWRs Expectation of enhanced margins of safety)
  - June 15, 1990, SRM on Safety Goal Implementation – (don't use industry's objectives to establish new requirements)
  - ALWR Design Certifications (industry proposed designs with enhanced safety, staff review resulted in additional case-by-case enhancements with Commission approval)

Enhanced Safety (Cont.)

- **Key Questions:**
  - How should the potential for additional plants (nationwide and on a per site basis) influence the level of safety required for future plants?
  - How should the Commission's performance goal to "maintain safety" impact the level of safety required for future plants?
  - Should enhanced accident prevention be required to help compensate for the larger uncertainties associated with non-LWRs, particularly these associated with severe core damage accidents?
  - Implications for future LWRs?

Enhanced Safety (Cont.)

- **Options:**

  a. Follow process used in ALWR Design Certification (DC) reviews.

     - expectation that applicants will provide enhanced safety
     - applicant proposed enhanced safety codified in DC or COL
     - staff proposed enhancements (with Commission approval) in areas of larger uncertainty

  b. Define requirements for enhanced level of safety, generically.

     - e.g., more stringent CDF

  c. Require enhanced level of confidence to eliminate areas of high uncertainty.

     - e.g., additional testing/additional oversight

Enhanced Safety (Cont.)

- Advantages of Requiring Enhanced Safety:
  - helps compensate for less experience
  - helps compensate for integrated risk of multiple units
  - public confidence
- Disadvantages of Requiring Enhanced Safety:
  - could imply current plants are not safe enough
  - could result in dual set of regulatory requirements

Enhanced Safety (Cont.)

- Recommendation:
  - use process similar to that used on ALWR Design Certification
  - modular designs should account for integrated risk of multiple reactors
  - incremental risk from additional plants expected to be small, due to safer designs

Defense-in-Depth (DID)

- **Issue: How to specify DID for non-LWRs:**
  - Mentioned in Commission policies, but no articulation as to the elements of DID
  - Concept described briefly in 10 CFR 50, Appendix R (Fire Protection)
  - Commission definition of DID provided in 1999 risk-informed, performance-based regulation white paper
- **Key Questions:**
  - Would a more comprehensive description of DID be useful?
    - for the NRC staff?
    - for reactor designers?
    - for other activities?

Defense-in-Depth (DID) (Cont.)

- Key Questions (Cont.):
  - What should be considered as elements of DID:
    - programmatic (e.g., QA, EP, ISI, etc.)
    - physical (e.g., barriers, redundancy, etc.)
    - process (e.g., treatment of uncertainties, safety not reliant on single element)
    - prevention vs. mitigation
    - structuralist vs. rationalist approach
  - Would the revised reactor oversight program cornerstones be a good DID structure?

Options:

a. Case-by-case determination, depending upon:
   - Plant Design
   - Uncertainties

b. Develop description or policy statement articulating specific programmatic and/or physical elements of DID.

Defense-in-Depth (DID) (Cont.)

- Options (Cont.):

  c. Develop description or policy statement articulating DID as a process.

- Advantages of developing a description of DID:

  – Provides guidance on how to implement the DID philosophy discussed in Commission policies

  – Could form the foundation for a future plant licensing framework

  – Could be useful in areas other than reactor licensing (e.g., Regulatory Analysis)

- Advantages of applying a case-by-case determination of DID:

  – details of DID are too design dependent

- Recommendation

  – Develop description or policy statement of DID:
    - details to be developed as a follow up action

International Codes and Standards

- **Issue: How should NRC requirements for non-LWRs relate to international safety standards and requirements?**
  - international nature of design and marketing efforts
  - less NRC experience and infrastructure for non-LWRs
  - design and safety consensus standards
- **Key Questions:**
  - Applicability of NRC Management Directive 6.5, "NRC Participation in the Development and Use of Consensus Standards"?
  - How should NRC decide on the extent to which it should participate in international codes and standards activities?
  - What international codes and standards activities should NRC participate in:
    - IAEA safety standards?
    - ISO?
    - Others?

International (Cont.)

- Options:

  a. Review international codes and standards on an as necessary basis as part of an applicant's licensing or pre-application submittal.

  b. Participate in the identification, development, and endorsement international codes and standards and endorse, whenever practical.

  c. Attempt to harmonize requirements with other regulatory bodies.

Advantages of utilizing international codes and standards:

- Can help fill gaps in NRC infrastructure (efficiency)
- NRC benefits from international experience
- Consistent with Management Directive 6.5
- Public confidence?

International (Cont.)

- Advantages of not utilizing international codes and standards:
  - can focus resources on what applicants present for review
  - standards may be too general to be of much use?
- Recommendation:
  - proactively identify, participate in the development and endorse international standards, whenever practical, e.g.,
    - fill gaps in NRC infrastructure
    - improve NRC efficiency
    - needed to review an application

Event Selection

- Issue: To what extent can a probabilistic approach be used to establish the licensing basis for:
  - Event selection?
  - Safety classification?
  - Replace single failure criterion?
- Previous Commission Guidance (July 30, 1993 SRM):
  - Select events to be considered deterministically, supplemented with PRA insights
  - Catagorize events according to expected frequency
  - Deterministically select challenging events for assessment of source term, containment evaluation and margins

Event Selection (Cont.)

- Key Questions:
  - Does a probabilistic approach go beyond the intent of the Commission's 1995 PRA Policy Statement?
  - What are the implications of bringing PRA more directly into the licensing basis:
    - PRA quality / completeness?
    - Document control?
    - Level of confidence?
  - How should PRA success criteria interface with DBA acceptance criteria?
  - What should be the criteria for:
    - event selection?
    - safety classification?

Event Selection (Cont.)

- Options:

  a. Use a deterministic approach supplemented by PRA (1993 Commission Guidance).

  b. Use a probabilistic approach.

  c. Use a probabilistic approach, supplemented by engineering judgement.

- Advantages of probabilistic approach:

  – provides more realism (i.e., integrates design, operation, human) in safety review

  – consistent with Commission's emphasis on risk-informed regulation

Event Selection (Cont.)

- Disadvantages of probabilistic approach:
  - larger uncertainties in non-LWR PRAs may make PRA less useful
  - could require more extensive R+D to provide data and models to support useable PRA
- Recommendation:
  - use a probabilistic approach, supplemented by engineering judgement for event selection, safety classification and to replace the single failure criterion
    - criteria to be developed as part of framework development.

Source Term

- Issue: Under what conditions should scenario specific accident source terms be used for licensing decisions?

- Previous Commission Guidance (July 30, 1993 SRM):

  - approved the use of scenario specific source terms provided there is sufficient understanding of plant and fuel performance as well as fission product transport under normal and off-normal conditions

  - events selected for source term evaluation should bound design dependent uncertainties and severe accidents

- Key Questions:

  - should a source term representative of severe core damage be a fundamental element of DID?

  - what level of confidence should be required in selecting source terms?

Source Term (Cont.)

- Options:

  a. Develop a deterministic bounding ST.
  b. Allow the use of scenario specific ST (1993 Commission Guidance).

- Advantages of Using Scenario Specific Source Terms:

  – adds more realism to analysis

  – provides incentive for designers to stress accident prevention

  – performance-based

  – consistent with event selection approach

- Disadvantages of Using Scenario Specific Source Terms:

  – puts large burden on understanding plant, fuel and fission product behavior over the life of the plant

- Recommendation:

  – retain 1993 Commission guidance
    - conservative assessment of accident scenarios and FP release

Containment vs. Confinement

- Issue: Under what conditions can a plant be licensed without a pressure retaining containment building?

- Previous Commission Guidance (July 30, 1993 SRM)
  - building must be adequate to meet radionuclide release limits
  - for 24 hours following the onset of core damage, the limiting building leak rate assumed in the accident evaluation shall not be exceeded. After 24 hours – no uncontrolled release of radioactivity.

- Key Questions:
  - should a pressure retaining building be a fundamental element of DID?
  - can the presence of a pressure retaining building have an adverse impact on safety? Improve safety?
  - what criteria should be applied to allow the use of a non-pressure retaining building?

Containment vs. Confinement (Cont.)

- **Options:**

  a. Require a pressure retaining building.

  b. Allow a design without a pressure retaining building, provided certain criteria are met (1993 Commission guidance).

- **Advantages of a Pressure Retaining Building:**

  – less concern about fuel quality and performance

  – less concern about air or water ingress accidents in HTGRs or LMRs.

  – public confidence?

Containment vs. Confinement (Cont.)

- Disadvantages of a Pressure Retaining Building:
  - provides less incentive for designers to stress accident prevention
  - allows pressure in building to act as mechanism to release radioactive material
  - could make passive decay heat removal systems more complicated
- Recommendations:
  - supplement 1993 Commission guidance
  - utilize results of event selection and ST to determine containment challenge
  - add an additional criterion – addition of pressure retaining building does not substantially improve safety

Emergency Preparedness

- Issue: Under what conditions can the EPZ be reduced, including a reduction to the exclusion area boundary?

- Previous Commission Guidance (July 30, 1993, SRM):
  - Premature to revise emergency planning for advanced reactors
  - Staff should remain open to suggestions to simplify EP for reactors that are designed with greater safety margins

- Key Issues:
  - Should an assumed severe core damage accident be the basis for EP for non-LWRs?
  - What criteria should be used to allow a reduction in current EP requirements?
  - Are the current requirements sufficiently flexible in the near term?
    - e.g., 10 CFR 50.47 already allows case-by-case EPZ determination for HTGRs

Emergency Preparedness (Cont.)

- Options:

  a. No reduction from current requirements at this time (1993 Commission guidance).

  b. Allow a reduction in the EPZ.

- Advantages of reducing the EPZ:

  – Provides incentive for designers to stress accident prevention

- Disadvantages of reducing the EPZ:

  – Public confidence?

- Recommendation

  – retain 1993 Commission guidance

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2.1. Materials and Chemical Engineering

2.1.1. Reactor Vessel Material Surveillance Program

Regulatory Evaluation

The reactor vessel material surveillance program provides a means for determining and monitoring the fracture toughness of the reactor vessel beltline materials to support analyses for ensuring the structural integrity of the ferritic components of the reactor vessel. The NRC staff's review primarily focuses on the effects of the proposed EPU on the licensee's reactor vessel surveillance capsule withdrawal schedule. The NRC's acceptance criteria are based on (1) GDC-14 for assuring an extremely low probability of rapidly propagating fractures of the reactor coolant pressure boundary (RCPB); (2) GDC-31 for assuring that the RCPB will behave in a nonbrittle manner and the probability of a rapidly propagating fracture is minimized; (3) 10 CFR Part 50, Appendix H, for determination and monitoring of fracture toughness; and (4) 10 CFR 50.60 for compliance with the requirements of 10 CFR Part 50, Appendix H. Specific review criteria are contained in SRP Section 5.3.1.

Technical Evaluation

[Insert technical evaluation.]

Conclusion

The NRC staff has reviewed the licensee's evaluation of the effects of the proposed EPU on the reactor vessel surveillance withdrawal schedule and concludes that the licensee has adequately addressed changes in neutron fluence and their effects on the schedule. The NRC staff further concludes that the reactor vessel capsule withdrawal schedule is appropriate to ensure that the material surveillance program will continue to meet the requirements of GDC-14, GDC-31, 10 CFR Part 50, Appendix H, and 10 CFR 50.60 following implementation of the proposed EPU. Therefore, the NRC staff finds the proposed EPU acceptable with respect to the reactor vessel material surveillance program.

2.1.2. Pressure-Temperature Limits

Regulatory Evaluation

Pressure-temperature (P-T) limits are established to ensure the structural integrity of the ferritic components of the RCPB during any condition of normal operation, including anticipated operational occurrences and hydrostatic tests. The NRC staff's review of P-T limits covers the P-T limits' methodology and the calculations for the specified effective full power years, considering neutron embrittlement effects and using linear elastic fracture mechanics. The NRC's acceptance criteria for P-T limits are based on (1) GDC-14 for assuring an extremely low probability of abnormal leakage, rapidly propagating failure, and gross rupture of the RCPB; (2) GDC-31 for assuring that the RCPB will behave in a nonbrittle manner and the probability of a rapidly propagating fracture is minimized; (3) 10 CFR Part 50, Appendix G, for material testing and fracture toughness; and (4) 10 CFR 50.60 for compliance with the requirements of 10 CFR Part 50, Appendix G. Specific review criteria are contained in SRP Section 5.3.2.

Technical Evaluation

[Insert technical evaluation.]

Conclusion

The NRC staff has reviewed the licensee's evaluation of the effects of the proposed EPU on the P-T limits for the plant and concludes that the licensee has adequately addressed changes in neutron fluence and their effects on the P-T limits. The NRC staff further concludes that the licensee has demonstrated the validity of the proposed P-T limits for the proposed EPU operation. Based on this, the NRC staff concludes that the proposed P-T limits will continue to meet the requirements of GDC-14, GDC-31, 10 CFR Part 50, Appendix G, and 10 CFR 50.60 following implementation of the proposed EPU. Therefore, the NRC staff finds the proposed EPU acceptable with respect to the proposed P-T limits.

2.1.3. Reactor Internal and Core Support Materials

Regulatory Evaluation

The reactor internals and core supports include structures, systems, and components (SSCs) that perform safety functions and/or whose failure could affect safety functions performed by other SSCs. These safety functions include reactivity monitoring and control, core cooling, and fission product confinement (within both the fuel cladding and the reactor coolant system). The NRC staff's review covers the materials' specifications and mechanical properties, welds, weld controls, nondestructive examination procedures, corrosion resistance, and susceptibility to degradation. The NRC's acceptance criteria for reactor internal and core support materials are based on GDC-1 and 10 CFR 50.55a for material specifications, controls on welding, and inspection of reactor internals and core supports. Specific review criteria are contained in SRP Section 4.5.2 and BWRVIP-26.

Technical Evaluation

[Insert technical evaluation.]

Conclusion

The NRC staff has reviewed the licensee's evaluation of the effects of the proposed EPU on the susceptibility of reactor internal and core support materials to known degradation mechanisms and concludes that the licensee has identified appropriate degradation management programs to address the effects of changes in operating temperature and neutron fluence on the integrity of reactor internal and core support materials. The NRC staff further concludes that the licensee has demonstrated that the reactor internal and core support materials will continue to be acceptable and will continue to meet the requirements of GDC-1 and 10 CFR 50.55a following implementation of the proposed EPU. Therefore, the NRC staff finds the proposed EPU acceptable with respect to reactor internal and core support materials.

2.1.4. Reactor Coolant Pressure Boundary Materials

Regulatory Evaluation

The RCPB defines the boundary of systems and components containing the high pressure fluids produced in the reactor. The NRC staff's review of RCPB materials covers their specifications, compatibility with the reactor coolant, fabrication and processing, susceptibility to degradation, and degradation management programs. The NRC's acceptance criteria for RCPB materials are based on (1) GDC-1 and 10 CFR 50.55a for quality standards; (2) GDC-4 for compatibility of components with environmental conditions; (3) GDC-14 and GDC-31 for assuring an extremely low probability of rapidly propagating fracture or gross rupture of the RCPB; and (4) 10 CFR Part 50, Appendix G, for materials testing and acceptance criteria for fracture toughness of the RCPB. Specific review criteria are contained in SRP Section 5.2.3. Additional review guidance for primary water stress corrosion cracking (PWSCC) of dissimilar metal welds and associated inspection programs is contained in GL 97-01, IN 00-17, BL 01-01, BL 02-01, and BL 02-02. Additional review guidance for thermal embrittlement of cast austenitic stainless steel components is contained in a letter from C. Grimes, NRC, to D. Walters, Nuclear Energy Institute (NEI), dated May 19, 2000.

Technical Evaluation

[Insert technical evaluation.]

Conclusion

The NRC staff has reviewed the licensee's evaluation of the effects of the proposed EPU on the susceptibility of RCPB materials to known degradation mechanisms and concludes that the licensee has identified appropriate degradation management programs to address the effects of changes in system operating temperature on the integrity of RCPB materials. The NRC staff further concludes that the licensee has demonstrated that the RCPB materials will continue to be acceptable following implementation of the proposed EPU and will continue to meet the requirements of GDC-1, GDC-4, GDC-14, GDC-31, 10 CFR Part 50, Appendix G, and 10 CFR 50.55a. Therefore, the NRC staff finds the proposed EPU acceptable with respect to RCPB materials.

2.1.5. Protective Coating Systems (Paints) - Organic Materials

Regulatory Evaluation

Protective coating systems (paints) provide a means for protecting the surfaces of facilities and equipment from corrosion and contamination from radionuclides and also provide wear protection during plant operation and maintenance activities. The NRC staff's review covers protective coating systems used inside the containment for their suitability for and stability under DBA conditions considering radiation and chemical effects. The NRC's acceptance criteria for protective coating systems are based on (1) 10 CFR Part 50, Appendix B, for the quality assurance requirements for the design, fabrication, and construction of safety-related SSCs and (2) Regulatory Guide 1.54, Revision 1, for application and performance monitoring of coatings in nuclear power plants. Specific review criteria are contained in SRP Section 6.1.2.

Technical Evaluation

[Insert technical evaluation.]

Conclusion

The NRC staff has reviewed the licensee's evaluation of the effects of the proposed EPU on protective coating systems and concludes that the licensee has appropriately addressed changes in conditions following a design-basis loss-of-coolant accident and their effects on the protective coatings. The NRC staff further concludes that the licensee has demonstrated that the protective coatings will continue to be acceptable following implementation of the proposed EPU and will continue to meet the requirements of 10 CFR Part 50, Appendix B. Therefore, the NRC staff finds the proposed EPU acceptable with respect to protective coatings systems.

2.1.6. Flow-Accelerated Corrosion

Regulatory Evaluation

Flow-accelerated corrosion (FAC) is a corrosion mechanism occurring in carbon steel components exposed to flowing single- or two-phase water. The components made from stainless steel are immune to FAC, and FAC is significantly reduced in components containing small amounts of chromium or molybdenum. The rates of material loss by FAC depends on velocity of flow, temperature, steam quality, oxygen content, and pH. During plant operation, control of these parameters is limited and the optimum conditions for minimizing FAC effects, in most cases, cannot be achieved. Loss of material by FAC will, therefore, occur. The NRC staff reviews the effects of the proposed EPU on FAC and the adequacy of the licensee's FAC program to predict the rate of loss so that repair or replacement of damaged components could be made before they reach critical thickness. The licensee's FAC program is based on NUREG-1344, Generic Letter 89-08, and the guidelines in EPRI Report NSAC-202L-R2. It consists of predicting loss of materials using the CHECWORKS computer code, and visual inspection and volumetric examination of the affected components. The NRC's acceptance criteria are based on the structural evaluation of the minimum acceptable wall thickness for the components undergoing degradation by FAC.

Technical Evaluation

[Insert technical evaluation.]

Conclusions

The NRC staff has reviewed the licensee's evaluation of the effect of the proposed EPU on the FAC analysis for the plant and concludes that the licensee has adequately addressed changes in the plant operating conditions on the FAC analysis. Further, the NRC staff concludes that the licensee has demonstrated that the updated analyses will predict the loss of material by FAC and will ensure timely repair or replacement of degraded components following implementation of the proposed EPU. Therefore, the NRC staff finds the proposed EPU acceptable with respect to FAC.

2.1.7. Reactor Water Cleanup System

Regulatory Evaluation

The reactor water cleanup system (RWCS) provides a means for maintaining reactor water quality by filtration and ion exchange and provides a path for removal of reactor coolant when required. The NRC staff's review of the RWCS includes component design parameters for flow, temperature, pressure, heat removal capability, and impurity removal capability; and the instrumentation and process controls for proper system operation and isolation when necessary. The review consists of evaluating the adequacy of the applicant's technical specifications in these areas. The NRC's acceptance criteria for the RWCS are based on (1) GDC-14 for ensuring the RCPB integrity, (2) GDC-60 for the capability of the RWCS to control the release of radioactive effluents to the environment, and (3) GDC-61 for appropriate confinement of fluids in the RWCS. Specific review criteria are contained in SRP Section 5.4.8.

Technical Evaluation

[Insert technical evaluation.]

Conclusion

The NRC staff has reviewed the licensee's evaluation of the effects of the proposed EPU on the RWCS and concludes that the licensee has adequately addressed changes in impurity levels and pressure and their effects on the RWCS. The NRC staff further concludes that the licensee has demonstrated that the RWCS will continue to be acceptable following implementation of the proposed EPU and will continue to meet the requirements of GDC-14, GDC-60, and GDC-61. Therefore, the NRC staff finds the proposed EPU acceptable with respect to the RWCS.

[2.1.8. Additional Review Areas (Materials and Chemical Engineering)]

[Insert Regulatory Evaluation, Technical Evaluation, and Conclusion Sections as necessary]