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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

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RELIABILITY AND PRA SUBCOMMITTEE

+ + + + +

WEDNESDAY,

MARCH 7, 2012

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear
Regulatory Commission, Two White Flint North, Room
T2B1, 11545 Rockville Pike, at 8:30 a.m., JOHN W.
STETKAR, Chairman, presiding.

MEMBERS PRESENT:

JOHN W. STETKAR, Chairman

SAID ABDEL-KHALIK

J. SAM ARMIJO

DENNIS C. BLEY

MICHAEL CORRADINI

HAROLD B. RAY

JOY REMPE

MICHAEL T. RYAN

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MEMBERS PRESENT (Continued) :

- STEPHEN P. SCHULTZ
- WILLIAM J. SHACK
- JOHN D. SIEBER
- GORDON R. SKILLMAN

NRC STAFF PRESENT:

- JOHN LAI, Designated Federal Official
- CHARLES ADER
- DONALD DUBE
- TODD HILSMEIER
- EDWIN FULLER
- RONALD FRAHM

ALSO PRESENT:

- BIFF BRADLEY
- VESNA DIMITRIJEVIC

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

(8:30 a.m.)

1. OPENING REMARKS

CHAIR STETKAR: The meeting will now come to order. This is a meeting of the Reliability and PRA Subcommittee. I am John Stetkar, Chairman of this Subcommittee meeting.

ACRS members in attendance are Jack Sieber, Steve Schultz, Dick Skillman, Dennis Bley, Harold Ray, Sam Armijo, Mike Ryan, Said Abdel-Khalik, Bill Shack, Joy Rempe, and Dr. Michael Corradini. John Lai of the ACRS staff is the designated federal official for this meeting.

The Subcommittee will hear the staff's discussion of the draft Commission paper and the results of the tabletop exercises in response to the Commission Staff Requirements Memorandum of March 2nd, 2011 on SECY-10-0121 regarding risk-informed regulatory guidance for new reactors. We will hear presentations from the NRC staff and the Nuclear Energy Institute.

There will be a phone bridge line. To preclude interruption of the meeting, the phone will be placed in a listen-in mode during the presentations and Committee discussions.

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1 opportunity to present. Staff has done a lot of hard
2 work here. And I think we're bringing this issue
3 hopefully to a close. Other than that, I'll turn it
4 back to Don.

5 CHAIR STETKAR: Don, it's all yours.

6 MR. DUBE: Thank you, John. I want to
7 acknowledge my colleague from Nuclear Reactor
8 Regulation Ron Frahm, who is going to cover the
9 reactor oversight process and tabletop results. I
10 think you'll find that really interesting and a
11 different direction than the licensing.

12 I also want to acknowledge Eric Powell,
13 who, unfortunately, took ill, literally ill. So I'm
14 going to be covering his topic. I will do the best I
15 can given a little bit of last moment. He was going
16 to cover 50.69. Fortunately, I noticed in the
17 audience the very active participation on 50.69
18 tabletop in August with the Electric Power Research
19 Institute as well as Vesna Dimitrijevic from AREVA,
20 who actually did some simulations for an active new
21 reactor design. And so if we get into detail, I'll
22 ask them to help answer some questions.

23 3. 50.69 AND RG 1.174 TABLETOP EXERCISES

24 MR. DUBE: So, with that, we'll move on.
25 It's going to be, you know, a pretty complete day. I

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1 don't think we'll go until 4:00 or 5:00, but it's
2 going to be a very long day.

3 CHAIR STETKAR: Don't challenge us.

4 (Laughter.)

5 MR. DUBE: What we're going to plan to do
6 is discuss the second series of tabletop exercise
7 results and the staff's response to the SRM, basically
8 going over the draft Commission paper. The
9 Commissioner paper, the final, I'm sure we're going to
10 get stakeholder response. and plan to change it in
11 terms of content. Structurally it might change a
12 little bit, but the options are the options and the
13 recommendations are pretty much the recommendations.

14 So on the agenda today, we will discuss
15 50.69 really at a high level, what we concluded from
16 the tabletop exercise. This is on classification of
17 structures, systems, and components, and special
18 treatment thereof. Reg guide 1.174, it's really the
19 process, the thought process, that went through
20 hypothesizing some license amendment requests,
21 risk-informed, and what's the thought process by which
22 the staff would review those and would it make any
23 difference if we have a new reactor proposing a
24 license amendment.

25 Large release frequency to large early

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1 release frequency, this is a legacy going back 20
2 years or more. We felt it was part of the assignment,
3 if you will, in the Commission SRM. And we want to
4 bring some closure to this at some point.

5 We talk about the process for ex-vessel
6 severe accident features, the change process. We'll
7 talk about a gap that the staff identified in the
8 current rule, if you will, and a recommendation to
9 address that.

10 I think you will find reactor oversight
11 process with very interesting results. We did dozens
12 upon dozens of scenarios and cases and with some
13 interesting results.

14 In the afternoon, we'll talk about
15 conclusions, the options, recommendations in the draft
16 paper and then the next step. So sit back and relax.
17 It's going to be a full day.

18 Going back over a year now, a year and a
19 half, in the original Commission paper, 0121, staff
20 proposed to the Commission three options to address
21 the risk-informed framework for new reactors. And
22 this included status quo or treat new reactors the
23 exact same way as the current operating reactors.

24 Option two was, well, let's go a little
25 bit further, let's do some investigation, let's look

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1 at the existing guidance, make sure there's no
2 significant decrease in the enhanced level of safety
3 of the new reactor designs as a result of implementing
4 risk-informed guidance. This was the staff's
5 recommendation.

6 Option three was even more radical, which
7 was let's just use new numeric thresholds for new
8 reactors, both in licensing and in reactor oversight.

9 MEMBER CORRADINI: And that was too
10 radical for the staff?

11 MR. DUBE: For the Commission. So the
12 Commission approved a hybrid of options one and two.
13 It's probably more option two-ish, but they said
14 continue the existing risk-informed framework pending
15 a series of tabletop exercises that test this
16 guidance. And so that's what the tabletop exercises
17 were.

18 To test the guidance, we did not test
19 every risk-informed application. I mean, it's just
20 not feasible to do it in the time and resources. We
21 did test the ones that were of greatest interest to
22 the Commission that they spelled out explicitly.

23 But the Commission went further than to
24 just say, "Go do these tabletops." They said that
25 they reaffirmed the existing safety goals in terms of

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1 core damage frequency and quantitative health
2 objectives, safety performance expectation, subsidiary
3 risk goals and associated risk guidance, the key
4 principles in reg guide 1.174 -- and I'll refresh your
5 memories on that -- and specifically the quantitative
6 metrics.

7 So that set the boundary conditions for
8 the tabletop. I mean, you know, to be true to the
9 Commission SRM, we had to work within those
10 boundaries, which means we're not going to change
11 quantitative metrics, period. So the metrics that
12 aren't used for current operating fleet we're going to
13 use for the new reactors. But maybe there are some
14 additional qualitative considerations that we could
15 work into it. But that set the stage for the
16 affirming.

17 CHAIR STETKAR: Don?

18 MR. DUBE: Yes?

19 CHAIR STETKAR: And we'll probably get
20 into this as we go on. Your interpretation of
21 quantitative metrics shall not be changed is that
22 every single number that appears anywhere in any
23 regulatory guide is cast in concrete or the concept of
24 the quantitative metrics shouldn't be changed?

25 MR. DUBE: Some of the key measures, like

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1 a change in core damage frequency, change in large
2 early release frequency, I interpret that to mean
3 those are firm.

4 CHAIR STETKAR: Okay.

5 MR. DUBE: The Commission expected advance
6 technologies and the new reactors will result in
7 enhanced margins of safeties. And, at a minimum, new
8 reactors have the same degree of protection of the
9 public and environment as current fleet.

10 And they went further, and they said, "New
11 reactors with these enhanced margins of safety should
12 have greater operational flexibilities than current
13 reactors."

14 MEMBER CORRADINI: So that would mean
15 that, even though you stick with the same numbers, you
16 ought to see a larger margin when you look at new
17 reactors?

18 MR. DUBE: Right.

19 MEMBER CORRADINI: And it's up to the
20 staff to decide what large is? In other words, even
21 if you fall within a CAP, the expectation of staff is
22 that they're actually going to see when you do an
23 exercise to see a larger difference?

24 MR. DUBE: Yes. One should not be pushing
25 the goals as aggressively as currently, but it is

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1 allowed. So, I mean, it's a very tough fine line to
2 walk.

3 MEMBER CORRADINI: I understand.
4 Understood. But, to put it differently, if you have
5 some leading indicators of how things might change; in
6 other words, you have a new plant, you want to change
7 something and the change increases the risk, the
8 allowable risk increase might be different for a new
9 plant versus an old plant because the expectation is
10 the margin should be larger?

11 MR. DUBE: Right.

12 MEMBER CORRADINI: Okay.

13 MR. DUBE: So how that reflects itself is
14 the current operating fleet with nominal risk profile
15 and core damage frequency and large early release
16 frequency, a doubling or tripling of core damage
17 frequency really would be an eye-opener.

18 A new reactor -- let's take ESBWR, which
19 goes to internal events. It says they're 10⁻⁸ per
20 year. We're not going to be so worried if there's a
21 doubling of that because of some change because, quite
22 frankly, there are probably other external events that
23 are dominating anyway. And there is a large margin
24 there. A doubling of that is not as much of an
25 eye-opener as it might be for the current fleet.

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1 MEMBER CORRADINI: But -- okay. That's
2 enough for now. I'll just --

3 MEMBER SCHULTZ: Don, you had -- excuse
4 me.

5 MR. DUBE: Go ahead.

6 MEMBER SCHULTZ: Don, you haven't added
7 that last bullet. That comes from the --

8 MR. DUBE: Yes.

9 MEMBER SCHULTZ: -- Commission's
10 expression.

11 MR. DUBE: This is the --

12 MEMBER SCHULTZ: So if I take what is
13 there on the slide at face value, the new reactors
14 would have additional margin of safety than existing
15 reactors against the current guidelines and goals, but
16 there is greater operational flexibility allowance.

17 MR. DUBE: Exactly.

18 MEMBER SCHULTZ: And so within that
19 additional margin that is available, there would be
20 the opportunity for the operator to use that
21 operational flexibility.

22 MR. DUBE: Right. And I think that's
23 consistent with what I was just saying.

24 MEMBER CORRADINI: And when we're done,
25 we're going to hear how you're going to trip that

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1 light fantastic between the hard --

2 MR. DUBE: Well, yes. I mean, I think
3 we'll see that this recurring theme as we went through
4 these tabletop exercises --

5 MEMBER CORRADINI: Okay. All right.

6 MR. DUBE: -- defense-in-depth margin of
7 safety were really two key principles.

8 MEMBER ABDEL-KHALIK: You said that for
9 the -- you gave the ESBWR as an example. And you said
10 the doubling of the 10-8 would not raise any eyebrows.
11 How about a hundred-fold increase?

12 MR. DUBE: Yes, that would.

13 MEMBER ABDEL-KHALIK: It would?

14 MR. DUBE: That would.

15 MEMBER ABDEL-KHALIK: But it would still
16 be within the numerical guidelines.

17 MR. DUBE: Right, but in order to do that
18 --

19 CHAIR STETKAR: A 10,000-fold increase
20 would still be within.

21 MR. DUBE: Right. In order to do that --

22 MEMBER ABDEL-KHALIK: I forgot, just
23 trying not to push that --

24 MR. DUBE: In order to do that, what
25 probably occurred along the way is a significant

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1 decrease in defense-in-depth and other principles.
2 And, again, this will be a recurring theme. Having a
3 small change in core damage frequency is for -- small
4 risk increase is necessary but not sufficient. And if
5 there's a significant decrease in defense-in-depth,
6 staff would have consulted that.

7 MEMBER ABDEL-KHALIK: And you'll tell us?

8 MR. DUBE: Yes. I will try to.

9 MEMBER ABDEL-KHALIK: Okay.

10 MEMBER CORRADINI: Can I ask a question?

11 MR. DUBE: Go ahead.

12 MEMBER CORRADINI: What you are really
13 saying is there is a larger uncertainty with the
14 smaller the number. And, therefore, if you were ever
15 able to compute the 95/95 using Professor Wallis'
16 approach to life, it wouldn't be 10-8. It might be
17 much higher.

18 MR. DUBE: Yes.

19 MEMBER CORRADINI: That's really what
20 you're saying.

21 MR. DUBE: Yes, that and also a
22 significant increase probably means that in order to
23 get that, a large amount of very important equipment
24 would be -- its performance would have changed or
25 might be out of service or special treatment thereof.

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1 And that's probably what it means. And so
2 defense-in-depth may have been eroded along the way.

3 So, again, I mean, we'll talk about the
4 key principles. But a small risk increase is just one
5 of the key principles.

6 So what were the tabletop exercises? It
7 was pretty aggressive, but it was fun. But it was a
8 busy 12 months.

9 At the September 20th Subcommittee meeting
10 of the ACRS, we talked about the first four or five
11 tabletops, but back before the SRM, we had started
12 looking at changed process for ex-vessel severe
13 accident design features. And we identified a
14 potential gap here. We'll talk about that. So I
15 won't go any further because we did talk about these
16 first few bullets.

17 At the last Subcommittee meeting, we
18 talked about risk-informed inspection of piping on May
19 4th. We did risk-informed tech spec initiative 4b.
20 This is on changing completion times where allowed
21 outage times is what's recalled in the past. And we
22 did that simultaneously with the maintenance rule
23 (a)(4), which is managing risk joint online
24 situations. They kind of go hand in hand. We gave
25 examples and talked quite a bit of detailed

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1 unbelievable participation by virtually all of the
2 reactor vendors, had well over 100 scenarios and cases
3 that we analyzed.

4 At the end of June, we did surveillance
5 frequency control program. We'll highlight those
6 results, but we talked about them on September 20th.
7 We found that that was really more governed by
8 performance monitoring than raw changes in risk, if
9 you will. What we did talk about on September 20 was
10 50.69. And I will go into it, at least at a high
11 level. We finished up on the change process for
12 ex-vessel severe accident features.

13 Then October 5th was a very busy day. We
14 did some scenarios on reg guide 1.174. Basically we
15 said let's hypothesize eight kinds of changes, license
16 amendments on a variety of plants. And we're not
17 going to get hung up on what the bottom line change in
18 core damage frequency or risk was. Let's go through
19 the thought process and the staff's thought process on
20 how we would review that and what would be some of the
21 considerations besides risk. And we really drew upon
22 some expertise in NRR with review of dozens of license
23 amendment requests. And they gave us some of the
24 thought process that we would carry over to the new
25 fleet. So that was a very good opportunity.

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1 We tackled this large release frequency as
2 a risk metric to large early release frequency. We
3 have come up with three major options and a
4 recommendation to finally handle this question.

5 And then a large portion was on the
6 reactor oversight process. There we did a
7 significance determination process for inspection
8 findings, reactive inspections under management
9 directive 8.3. This is like sending out a special
10 inspection or augmented inspection team because of a
11 plant incident. And then the mitigating systems
12 performance index and took actual examples from the
13 current fleet and said, well, if we applied something
14 like this to new reactor, what would the results kind
15 of look like? And does the response look like what we
16 would expect, you know, judgmentally? And I think
17 you'll find some interesting results.

18 We had a follow-up discussion on the ROP
19 on the 26th of October. So that was a very busy day.

20 So we'll talk about 50.69 at a high level.
21 Again, I'm filling in a little bit. I mean, I am
22 familiar with them obviously, but I'll be drawing upon
23 my colleague Eric Powell's notes a little more than I
24 might have otherwise. If there are real detailed
25 questions on the process, you know, we have got some

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1 representatives here I think.

2 So at a high level, 50,69 is a
3 classification of structures, systems, and components,
4 putting them into one of four bins and considering
5 what special treatments one may be able to eliminate.

6 At the upper left are the traditional
7 safety-related. And what the PRA might say as
8 safety-significant have always been thresholds for
9 using PRA metrics, like Fussell-Vesely or risk
10 achievement works that would put them in this bucket.
11 That would basically have the same treatment as the
12 current fleet, the current requirements.

13 RISC-2 is the non-safety-related but, for
14 whatever reason, safety-significant. It could be a
15 standby feedwater pump that's not an emergency
16 feedwater pump but because of the risk profile at a
17 plant plays an important role in mitigating loss of
18 feedwater events. And they may end up having risk
19 metrics above a certain value.

20 In new reactor space, at least for the
21 passive plants, there has been a great deal of overlap
22 between RISC-2 and the regulatory treatment of
23 non-safety systems. We have this category RTNSS. And
24 they do have special treatment for the passive plants,
25 like the AP1000 and ESBWR, which rely on passive

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1 safety features but have non-safety systems that are
2 not credited in the chapter 15 accident analysis but
3 provide a great deal of defense-in-depth. And these
4 might be a start-up feedwater pump, non-safety diesel
5 generator, non-safety residual heat removal system,
6 and the like. And those get special treatment. They
7 have typically reliability targets, if you will, and
8 unavailability targets. And so there is a good deal
9 of overlap, at least to the passive plants.

10 MEMBER SHACK: There is DRAP and ORAP for
11 the non-passive plants --

12 MR. DUBE: Yes, DRAP and ORAP.

13 MEMBER SHACK: -- which have a kind of a
14 similar --

15 MR. DUBE: Exactly, similar kind of
16 situation with targets like that. Right, exactly.
17 Thanks.

18 The next easy one, RISC-4, are
19 non-safety-related, low safety significance. So
20 those, there is not too much controversy.

21 MEMBER CORRADINI: Are there any kinds of
22 examples of those? It seems like depending on how I
23 do it, everything would fit in the other three bins.
24 What are some things that --

25 MR. DUBE: A lot of the things, most of

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1 the things fit, many of the things fit, in that
2 category.

3 MEMBER CORRADINI: This has the power
4 generation unit, I assume.

5 MR. DUBE: Yes, power generation.

6 MEMBER CORRADINI: But it isn't --

7 MR. DUBE: Drains pump? I don't know.
8 Something like that, some kind of --

9 MEMBER CORRADINI: Just so I've got it
10 right, relative to two to four, the difference in two
11 to four depends upon the parameter you use to decide.
12 In other words, if I turn the screws, a lot of four
13 becomes two.

14 MR. DUBE: Some fours become two.

15 MEMBER CORRADINI: Have I got it right?

16 MR. DUBE: Yes. I mean, there are risk
17 metrics, Fussell-Vesely of greater than particularly
18 0.005, which is half a percent contribution to core
19 damage frequency.

20 MEMBER CORRADINI: Especially ESBWR.

21 MR. DUBE: Right. Thank you.

22 CHAIR STETKAR: I knew that would come up.

23 (Laughter.)

24 CHAIR STETKAR: I mean, if I didn't say
25 it, he would say it. So I waited for the slide.

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1 MR. DUBE: Risk achievement worth greater
2 than 2 or common cause failure risk achievement worth
3 of greater than 20, but there are also some other
4 factors that may come into play. For example, there
5 could be --

6 MEMBER CORRADINI: That's fine.

7 MR. DUBE: Something might have a big
8 roll. It's a reliability impact, reactor trip
9 frequency. You know, this thing trips, kind of take
10 down the feedwater system and result ultimately in a
11 reactor trip. I mean, that could be enough to put it
12 over. And in the integrated decision-making panel,
13 they may have these qualitative and other
14 considerations of why they want to move it up.

15 MEMBER CORRADINI: That's fine. That's
16 fine.

17 MR. DUBE: RISC-3 is, you know, where all
18 of the issues have been in the past going back, you
19 know, almost a decade now, because these are
20 safety-related and low safety-significant. And this
21 is a category which is "Okay. How do we handle this?"

22 Fortunately, I mean, there is a regulation
23 in 50.69 of what to do with RISC-3. So it's pretty
24 firm. There's a fair degree of considerations that go
25 into what gets into RISC-3 and how it's treated.

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1 And just because it's in RISC-3, one
2 cannot ignore it. One has to monitor its performance
3 pretty aggressively if a RISC-3 has a component, has
4 a trend, an adverse trend in terms of failure rate,
5 corrective action has to be taken. It can't just be
6 left to degrade, even though it's determined to be of
7 low safety significance.

8 So I got permission from EPRI to use this
9 slide. This is just a high level --

10 MEMBER CORRADINI: Written?

11 MR. DUBE: No. This is at a high level.
12 And the guidance in NEI, 004 risk categorization of
13 the process. So at the extreme left, one looks at the
14 risk category characterization. That's a starting
15 point, everything from internal events to external
16 events and fire shutdown risk. And then depending, it
17 could take several paths, could go directly to high
18 safety significance, RISC-1 and RISC-2.

19 But, just because something is below the
20 quantitative guidelines and the guidance and starts
21 out as low safety significance, that's the garden path
22 LSS. There are a number of considerations, everything
23 from defense-in-depth; in other words, you know, maybe
24 PRA says, you know, this particular equipment doesn't
25 contribute that much but is it the only one of a kind

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1 and if that equipment had some kind of degradation, it
2 might impact because there's nothing else backing it
3 up, maybe it's a high-pressure injection function, if
4 you will, or something along those lines.

5 So there's defense-in-depth
6 characterization. Furthermore, there are new risk
7 sensitivity studies to see if the plant risk is
8 sensitive to performance of that equipment. And then,
9 really, that blue block is the integrated
10 decision-making panel review.

11 This is actually required by regulation.
12 And, in fact, it even spells out in the regulation the
13 characteristics, the expertise that has to make up
14 this IDP: operating experience, engineering review,
15 licensing requirements, PRA. It's a regulation. It's
16 a part of regulation.

17 And often they will take something for
18 other consideration besides risk that says, well, as
19 I mentioned earlier, maybe, you know, all PRA numbers
20 aren't above the threshold, but, you know, it's really
21 heavily relied upon for the design basis accident
22 analysis, defense-in-depth, for just power generation,
23 if you will, or other considerations. And they can
24 add to that, and they have added to that. And that
25 could bump it up into the high safety-significant

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1 category.

2 So what comes out of that, then, is the
3 RISC-1, the RISC-2, the RISC-3, and the RISC-4.

4 MEMBER CORRADINI: Don?

5 MR. DUBE: Yes?

6 MEMBER CORRADINI: Before you leave this
7 -- and I have to apologize because I know you are just
8 filling it. So you may actually need some help from
9 the back. I've not read or studied anyway any I/O
10 before. And, as I was going through the slides from
11 the workshop on this process, I came across something
12 that I found pretty interesting there, actually, in
13 one of EPRI's slides.

14 In particular, it has to do with the risk
15 sensitivity study results. They had kind of an
16 interesting plot showing as you uniformly increase
17 failure rates or something like that by factors of one
18 and a half, two, three high, and so forth, there is
19 kind of an anomaly or behavior. And that's sort of --
20 it's interesting for the IDP to look at that because
21 it gives you a sense of rates of change and margins,
22 if you will.

23 And I was curious. Is the guidance in NEI
24 0004 explicit about performing that type of sort of
25 progressive sensitivity calculation or is this just

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1 something that was done for this particular
2 application?

3 MR. DUBE: No, no. I think --

4 MEMBER CORRADINI: Is everybody doing it?

5 MR. DUBE: They do some kind of
6 sensitivity. The question is where do you stop? I
7 mean, it all -- increase the failure rate by one and
8 a half, there's not much controversy, then two, then
9 three. I mean --

10 CHAIR STETKAR: Well, that's exactly my
11 question, is, well, but I don't necessarily care about
12 the endpoint. And one could say, well, how big could
13 it be to trip over the acceptance criterion. I mean,
14 you know, that's --

15 MR. DUBE: Yes.

16 CHAIR STETKAR: That's a possible
17 endpoint. But what I was more concerned about, does
18 the process actually generate this type of progressive
19 information for input to the integrated
20 decision-making panel or do people only do a single
21 snapshot? Well, we'll give you the sensitivity study
22 with a factor of two increase, period, and not show
23 that progressive behavior.

24 MR. DUBE: I can't say that it's actual
25 practice. I don't know if --

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1 CHAIR STETKAR: That's what I say. I'm
2 not --

3 MR. DUBE: -- representatives from EPRI,
4 Patrick O'Regan or Dr. Dimitrijevic want to add
5 anything. Dr. Dimitrijevic did -- well, okay. Biff
6 Bradley from NEI.

7 MR. BRADLEY: I'm Biff Bradley, NEI.
8 Vesna may be better speaking to the specific thing
9 that John raised, but in 00-04, there was a tremendous
10 amount of discussion that went into that since the
11 factor and ultimately what we put in there was a
12 range. I think it was three to five. There is no
13 specific number. It was sort of left open for the
14 pilot to deal with.

15 CHAIR STETKAR: Yes, Biff. I am less
16 interested -- I don't care about the specific numbers,
17 whether they're one and a half or 1,500.

18 MR. BRADLEY: Yes.

19 CHAIR STETKAR: I am more concerned, does
20 the process create this type of plot that I pulled up
21 here that was shown in the EPRI results to show
22 essentially as you increase from one and a half, two,
23 three, five, how linear or non-linear are the results
24 to that theme because that is a piece of, the
25 non-linearity of that is a piece of, information that

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1 could be useful for the IBP to show, you know, how
2 fast are you eroding margins as a function of --
3 granted, you know, equipment failure rates aren't
4 going to change by uniformly a factor of ten
5 overnight.

6 On the other hand, if suddenly the curve
7 goes vertical between five and seven, that's sort of
8 an interesting piece of information.

9 MR. BRADLEY: Right. Yes. I'm pretty
10 sure the 00-04 doesn't speak explicitly to that
11 non-linearity, but there is additional EPRI guidance
12 out there.

13 Also, the issue that drove this was
14 primarily cross-system common-cause failure. So we
15 have a lot of guidance in there about grouping similar
16 types of components across systems and tracking
17 failure rates. That was the big controversy at the
18 time of 00-04.

19 I don't know if Vesna wants to add
20 something.

21 DR. DIMITRIJEVIC: This is not typically
22 --

23 CHAIR STETKAR: Even though we all know
24 you, you have to identify yourself because Charles
25 doesn't know you.

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1 DR. DIMITRIJEVIC: The NEI doesn't
2 actually specify the requirement for this sensitivity.
3 We did it in purpose of this tabletop. In that, you
4 will have to do these. So you will have to make an
5 assumption on some. And maybe in purpose of
6 presenting at the risk of this application, you can
7 choose to do the sensitivity to see what is --

8 CHAIR STETKAR: No. That helps. I was
9 just curious because I found it kind of an interesting
10 --

11 DR. DIMITRIJEVIC: I know.

12 CHAIR STETKAR: -- plot. You know, if I
13 was sitting back in that blue box there saying, "Well,
14 I meet all of these other criteria, but, see, I am
15 uncertain about the failure rate of a particular piece
16 of, oh, let's say, a very large squib valve."

17 And if there is some important
18 non-linearity in terms of delta risk as a function of
19 that failure rate, this gives me sitting in that box
20 another sense of quantitative information that I can
21 use to say, well, if I was close to the margin of
22 including that in one or another category, it might
23 affect my decision.

24 So from what I'm hearing, it's something
25 you did for the tabletop. It isn't necessarily

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1 something that --

2 DR. DIMITRIJEVIC: Yes.

3 MEMBER SHACK: It is in the guidance. I
4 mean, a risk sensitivity study is performed to
5 investigate the aggregate impact of potentially
6 changing treatment of these low safety-significant
7 components. That really sort of gets at what you're
8 looking at. You're really not just looking at even
9 one at a time, which is always a problem with the
10 sensitivity studies.

11 MR. DUBE: Except for the fact you can
12 interpret that by just assigning one number, you know,
13 just --

14 MEMBER SHACK: Risk sensitivity study I
15 suppose you could.

16 CHAIR STETKAR: I will look at the
17 sensitivity to the aggregate change in the failure
18 rate of everything by a factor of three, period. And
19 this exercise did that but at several different values
20 of that multiplier so that you could see you had a
21 different sense of -- as I said, if this suddenly went
22 vertical if you changed the failure rate from five to
23 seven, that's -- there's nothing to believe that
24 everything would change by that amount, but it does
25 give you some sense of sensitivity.

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1 MR. DUBE: I don't want to get too
2 mathematical here, but mathematically it makes sense
3 because if you start getting important cut sets, which
4 is an initiating event, A train and B train fail in a
5 cut set, it's a quadratic because if you increase the
6 failure rate of A and B, at some point that quadratic
7 starts to dominate.

8 CHAIR STETKAR: That's right. That's
9 right.

10 MR. DUBE: So if you push this limit far
11 enough, you really transition from linear to --

12 CHAIR STETKAR: Yes, yes.

13 MR. DUBE: But our challenge, back to
14 50.69, our challenge in here was, unlike risk-informed
15 tech spec, where there's maybe a dozen, probably
16 several dozen are implementing some form of
17 risk-informed tech specs, risk-managed tech specs, and
18 risk-informed and service inspection where I think
19 more than half of the fleet are implementing it.

20 We actually don't have anyone who has
21 actually implemented 50.69 per se. Now, South Texas
22 1 and 2 implemented something similar, graded QA. And
23 we have that experience. And Vogtle 1 and 2 are
24 volunteering, are going to be in a pilot I believe for
25 50.69. But we don't have a lot of experience to draw

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1 upon. So it was a little bit of a challenge.

2 So some of the ground rules on applying it
3 to new reactors, one does have to start out with an
4 initial classification in the traditional
5 safety-related, non-safety-related. What we were told
6 is on the tabletop, it would be nice to apply 50.69
7 before the equipment was purchased. I mean, that's
8 where the potential benefit is. But it's too late for
9 the current wave of the new reactor designs because,
10 you know, they have to send out the specs long ago,
11 long ago before they were in the case of Vogtle 3 and
12 4 were issued the COL. So it's actually probably too
13 late for that purpose. That was an interesting
14 incident.

15 MEMBER SHACK: But the passive plants have
16 cut back the scope of safety equipment rather
17 drastically anyway.

18 MR. DUBE: Yes, yes. Right. That's true.
19 And I'm not sure where they would --

20 MEMBER SHACK: EPR might benefit.

21 MR. DUBE: Perhaps, yes.

22 MEMBER SKILLMAN: For the new designs that
23 have not yet achieved design certification, why
24 wouldn't 50.69 be a requirement?

25 MR. DUBE: It's a requirement? It's

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1 voluntary by regulation. It's a voluntary rule. They
2 don't have to implement 50.69.

3 MEMBER SKILLMAN: Okay. Thank you.

4 CHAIR STETKAR: The only thing they do
5 have to do is the new plants have to -- if they're a
6 passive plant, they have to develop this --

7 MR. DUBE: The regulatory achievement and
8 not say --

9 CHAIR STETKAR: If they're an active
10 plant, they have to have a design reliability
11 assurance program.

12 MR. DUBE: Yes and operational -- so they
13 are required to have --

14 CHAIR STETKAR: They are required to have
15 that --

16 MR. DUBE: Yes.

17 CHAIR STETKAR: -- by rule.

18 MR. DUBE: Exactly.

19 CHAIR STETKAR: But it's kind of like
20 50.69, yes, except it doesn't have the vertical
21 component to take things out. It doesn't recategorize
22 things from one to three or two to four in principle.

23 MEMBER RAY: Well, Don, yesterday in the
24 context of ROP, I asked about how does it share with
25 appendix B. Now, we're just now talking about the

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1 benefits that arise from 560.69, the implication being
2 the benefits would be for the safety-related
3 components, I take it. I mean, that's the area of
4 benefit that I can see.

5 Does that mean that the requirements for
6 criteria of appendix B somehow would not apply to a
7 pump valve component of some kind?

8 MR. DUBE: If it is in category RISC-3 and
9 the applicant for this risk-informed initiative, 1 and
10 2 change the treatment of -- and they choose this --
11 of that component and say, you know, we will change
12 the treatment under appendix B or environmental
13 qualification or ASME IEEE codes and standards, a
14 whole list, appendix J testing, it could.

15 MEMBER RAY: They could do that
16 unilaterally or does that have to be --

17 MR. DUBE: The license amendment. Staff
18 has to review it by the license.

19 MEMBER RAY: So this is simply an
20 opportunity to seek a reduction in what otherwise
21 remain the regulatory requirements of appendix B. And
22 so that's where the --

23 MR. DUBE: The benefit in terms of
24 procurement would be a) if it's of this large -- if
25 there were a large set of equipment where they could

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1 buy equipment commercially, as opposed to under an
2 appendix B program with all the bells and whistles and
3 documentation.

4 MEMBER RAY: Even though it's
5 safety-related.

6 MR. DUBE: Yes.

7 MEMBER RAY: Okay. Well, that helps
8 answer the question I was trying to get at yesterday,
9 which is that this is a mechanism that has to be
10 actually used and approved --

11 MR. DUBE: Yes.

12 MEMBER RAY: -- in order to reduce what
13 are otherwise the requirements that continue to apply.

14 MR. DUBE: Exactly. And RISC-3 may remove
15 requirements RISC-2 adds. That's the benefit of this.

16 MEMBER RAY: Yes, I know, but that is
17 similar to what John is saying about RTNSS
18 requirements already exist. I'm trying to probe the
19 other side of it, which is the means by which this
20 relief is obtained. And I understand it to be what
21 the NRC has to approve.

22 MR. DUBE: Yes.

23 MEMBER RAY: Okay.

24 MR. DUBE: The staff will approve the
25 process and then ask a large number of questions that

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1 give examples of --

2 MEMBER RAY: Yes. I understand, but it
3 seems as though it's quite ad hoc, I guess I would
4 say, at this point. In other words, you've got to
5 make -- a specific licensee makes a specific proposal
6 to do something very precise and gets that approved,
7 but that's just a one-off kind of --

8 MR. DUBE: I wouldn't call it ad hoc. I
9 mean, there's a lot of guidance here. An actual
10 regulation --

11 MEMBER SHACK: Plant-specific. It's
12 plant-specific.

13 MEMBER RAY: All right. That's fine. I
14 chose the wrong word, then.

15 MR. DUBE: Yes.

16 MEMBER RAY: But the point is it's
17 plant-specific, then.

18 MR. DUBE: Yes.

19 MEMBER RAY: Okay. Under part 52, maybe
20 it applies to a lot of people.

21 CHAIR STETKAR: What it says is component
22 X at plant A may be in category 3; whereas, component
23 X, if you went and looked at that component, what
24 looks exactly like component X in plant A, in plant B,
25 it might still be in RISC-1.

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1 MEMBER RAY: Well, it really doesn't
2 automatically do anything in my mind, John. That's
3 why I'm asking the question the way I am. If it's
4 safety-related, appendix B still applies until you get
5 some relaxation.

6 CHAIR STETKAR: Well, but that 50.69 rule
7 gives you that relaxation.

8 MEMBER SHACK: It isn't in RISC-3 until
9 the NRC agrees it's in RISC-3.

10 MEMBER RAY: Well, I'm going to persist
11 here because it is something I'm still not satisfied.
12 But what RISC-3 means when it comes to a programmatic
13 requirement, which is in the regulations and is very
14 explicit and has forever been a programmatic issue as
15 far as enforcement is concerned, what exactly the
16 relief is needs to be identified. You don't just say
17 it's in RISC-3. Right?

18 MR. DUBE: Mr. Bradley from NEI is very
19 familiar with the guidance.

20 MR. BRADLEY: Yes. Biff Bradley, NEI.

21 Just for everyone's recollection, there
22 are high-level treatment requirements in 50.69 that
23 replace those of the regulations that you are exempted
24 from. And it is reasonable confidence versus
25 reasonable assurance. And it's test inspection and

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1 corrective action. And the plant has to set up
2 programs to address those for RISC-3.

3 Those are certainly auditable. And we're
4 going through all of that right now at Vogtle 1/2, as
5 someone mentioned. NRC has been heavily involved
6 observing the categorization as well as the treatment
7 aspects of it.

8 MEMBER RAY: Well, Biff, that does go to
9 the question I'm asking. At what point are the exact
10 programmatic requirements that are then subject to
11 enforcement or inspection and enforcement as a program
12 established at Vogtle?

13 MR. BRADLEY: It's a performance-based
14 rule. There is no reg guide that describes
15 programmatic expectation for RISC-3 treatment. It's
16 performance-based. So it's the performance
17 monitoring. And then for the accident functions,
18 which you can't necessarily glean from normal testing,
19 you have to make the case that you're providing
20 reasonable confidence of that. So there is no reg
21 guide that says, "Here's the RISC-3 program that we're
22 going to go inspect you to."

23 MEMBER RAY: That answers my question
24 better than anything else so far. So basically you
25 are exempted from the end, the RISC-3, but you then

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1 need to replace it with something. And the something
2 that you replace it with is a performance-based thing
3 of your own development, I guess I would say.

4 MR. BRADLEY: Yes.

5 MEMBER RAY: It doesn't come out of the
6 agency here. But programmatically it's up to you.
7 You no longer have to comply with appendix B if it's
8 in RISC-3, but you need to have something.

9 MR. BRADLEY: Correct.

10 MEMBER RAY: Okay.

11 MR. BRADLEY: And you're still subject to
12 if it fails whatever --

13 MEMBER RAY: Yes, yes, yes.

14 MR. BRADLEY: -- exposure you have there.

15 MEMBER RAY: Yes. Well, I understand, but
16 I was just asking about the programmatic issue --

17 MR. BRADLEY: Right.

18 MEMBER RAY: -- by itself.

19 MR. BRADLEY: Okay.

20 MR. DUBE: Good. I am glad that helped.

21 Really moving along, so the process
22 assumes a full-scope PRA or at least some
23 consideration if, say, for example, we have seismic
24 margins, instead of seismic PRA, that have to take
25 that in consideration and the same thing with

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1 shutdown. And then all functions are noted, including
2 beyond design basis functions.

3 So what we did during the exercise, during
4 the tabletop -- and we have, as I said, participants
5 -- Electric Power Research Institute gave an overview
6 of the process. And I'm not going to dwell on it.

7 Then a representative from AREVA talked
8 about, well, what if one would apply this process to
9 new active PWR? What would be the results in terms of
10 the classification of SSCs? What would the
11 distribution look like? Is it radically different
12 from our one test case past experience, South Texas,
13 or somewhat different? And General Electric-Hitachi
14 also did it on an ESBWR.

15 So we compared the new build and an
16 operating plant to try to --

17 MEMBER CORRADINI: Repeat that last part.
18 You were talking about the active PWR, but then you
19 parenthetically --

20 CHAIR STETKAR: That's on the next slide.

21 MEMBER CORRADINI: Oh. That is on the
22 next slide. Never mind.

23 MR. DUBE: GE-Hitachi also looked at --

24 MEMBER CORRADINI: Okay. It's in the next
25 slide. I missed that. I'm sorry.

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1 MR. DUBE: Now, the interesting --

2 MEMBER CORRADINI: I just won't ask.

3 MR. DUBE: -- thing to really keep in
4 mind, which brought home the point, is to think about
5 this. How many components are there in a new nuclear
6 power plant?

7 MEMBER CORRADINI: How do you define
8 component?

9 PARTICIPANT: Really.

10 MEMBER CORRADINI: Oh, for Christ sake.

11 MR. DUBE: Millions, right? Yet, in a
12 typical PRA, roughly 2,000 SSCs are modeled in the
13 PRA. They might have super-components, like a pump,
14 not a peace bar.

15 CHAIR STETKAR: Or a black box for the
16 entire I&C system, for example.

17 MR. DUBE: But the point is only a very
18 small fraction of the entire plant is modeled in the
19 PRA, which means that most -- if you just start with
20 the raw risk numbers, you're starting a very small
21 population that might populate RISC categories 1 and
22 2, if you will.

23 And so, really, a lot of emphasis is on
24 using the risk PRA results, what to do with those
25 2,000. Really, the bigger question is what do you do

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1 with the remaining several million minus 2,000 that
2 are --

3 CHAIR STETKAR: Well, but, Don, you know,
4 you have to be a bit careful when you start throwing
5 those numbers around because you have to presume the
6 people who do risk assessment are fairly intelligent
7 and they understand risk and they understand safety
8 and they understand power plants. So that, for
9 example, the motor operator on a particular door that
10 goes into the turbine building isn't in the PRA. And,
11 yet, it's probably one of your one million components
12 in a power plant.

13 So that saying that 2,000 over one million
14 is a small fraction of things is true in that sense,
15 but it's not true. You know, the assertion that there
16 are a lot of other things that you need to look at
17 that might be potentially important to risk doesn't
18 quite follow I don't think.

19 MR. DUBE: No. I'm sorry. I didn't mean
20 to say it's not important to risk. What I meant to
21 say is you'll have in the classification -- you don't
22 have PRA numbers to assign. And so you have to rely
23 more on this blue box --

24 CHAIR STETKAR: Yes, but the --

25 MR. DUBE: -- the defense-in-depth and the

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1 integrated decision-making panel. That was my --

2 CHAIR STETKAR: True. And there certainly
3 are at the margins things like radiation monitoring,
4 for example, some of those functions that don't get --

5 MR. DUBE: Sorry if I came across --

6 CHAIR STETKAR: You know, your example of
7 the heater drain pump or, you know, some waste-drain
8 transfer pump or something like that. In principle,
9 the blue box folks need to think about that but not
10 too hard.

11 MR. DUBE: Right. Okay. Thanks, Biff,
12 for helping.

13 And I'm going to give just a high level
14 what were the results of looking at the active
15 pressurized water reactor and comparing the
16 categorization to the operating reactors, roughly the
17 same categorization/distribution result. There were
18 some differences but in terms of which equipment or
19 SSCs felt in box 1, 2, 3 or 4 on a percentage basis,
20 recognizing that in this case it was not the entire
21 plant that was looked at.

22 And also the fact that in the
23 categorization that was done for the new reactor PWR,
24 they didn't go through the step for the
25 decision-making panel, which would tend to add to

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1 categories 1 and 2, but the categorization was roughly
2 equivalent to what was seen in South Texas project 1
3 and 2.

4 CHAIR STETKAR: Don, could you leave that
5 one up for a second? Because I wanted to ask a
6 question that EPRI may want to address. Because you
7 weren't directly involved, you probably can't. I was
8 looking at the results from that exercise. And the
9 slide that you had -- I guess go up to whatever slide
10 you had that -- the summary slide, that one right
11 there.

12 The second sub-bullet there says,
13 "Maximize the percentage of SSCs in RISC-3." There
14 might be some reduction in the future. And I read
15 some of that stuff.

16 And on the RISC-1 and 3 side of the
17 vertical line, the results sort of mirror what you
18 were saying qualitatively, that for what's
19 characterized as operating plants -- I'll call it
20 South Texas, and I'll use round numbers kind of --
21 about 75 percent of the safety-related stuff was in
22 RISC-3. And about 80, let's say 85 percent, was in
23 RISC-3 for this particular new-build active plant.
24 Those numbers are different, but they're not all that
25 different, --

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1 MR. DUBE: Yes.

2 CHAIR STETKAR: -- especially given the
3 uncertainties. I was more interested on the right
4 side of the vertical line, where for currently
5 operating plants, about 99 percent of the non-safety
6 equipment is in RISC-4; whereas, about 80 percent of
7 the non-safety-related equipment for the new-build
8 plant is in RISC-4. And that's a 20 percent in RISC-2
9 versus one percent in RISC-2. That's quite a large
10 difference.

11 And I was curious why that large
12 difference. If you are looking at the EPRI slides --
13 we don't have them in front of us here, unfortunately.
14 So I don't want to bring them into this discussion if
15 we don't need to do that.

16 MR. DUBE: Right.

17 CHAIR STETKAR: But I was somewhat curious
18 about why that large difference. I mean, on the
19 safety side of the line, the conclusion is, well,
20 there isn't anything different, you know,
21 substantively different from the exercise that South
22 Texas went through to lead us to believe that the
23 metrics wouldn't work as applied for differentiation
24 between RISC-1 and RISC-3, at least in terms of
25 populating bins of equipment. That doesn't seem to

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1 necessarily be true on the other side, though. I was
2 just curious --

3 MR. DUBE: For the specifics, Dr.
4 Dimitrijevic?

5 DR. DIMITRIJEVIC: Yes.

6 CHAIR STETKAR: I was hoping you would
7 come up.

8 DR. DIMITRIJEVIC: Yes. This is because
9 it is very clear, actually, because there was some
10 component modeled in PRA. The South Texas result
11 includes everything.

12 CHAIR STETKAR: Okay.

13 DR. DIMITRIJEVIC: So, therefore, because
14 we didn't have a disintegrated decision panel --

15 CHAIR STETKAR: Oh, okay. Thank you.
16 That I understand. Thank you.

17 MEMBER SCHULTZ: Don, for clarification,
18 can you go back the EPRI slide, 10? So is it assumed
19 that the disintegrated decision panel is going to only
20 consider the LSS arrow there that comes into the blue
21 box, and, therefore, the percentage of high safety
22 significance items can only increase --

23 MR. DUBE: Yes.

24 MEMBER SCHULTZ: -- as a result of the
25 panel or are they also looking at the input in other

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1 areas that are above that that come into them as
2 marked by the other evaluations as high safety
3 significance. Could they not put those in the low
4 safety significance category?

5 MR. DUBE: I believe in most cases, it
6 would bump up from LSS to HSS.

7 MEMBER BLEY: But they do look at the
8 others.

9 MR. BRADLEY: They look at everything.
10 Presented to the IDP as low, they can decide to make
11 high. And there are a whole bunch of provisions in
12 the guidance for reasons you might want to do that,
13 even though it came out low. If it's presented as
14 high, they cannot make it low.

15 MEMBER RAY: Right.

16 MR. BRADLEY: There are a handful of
17 conditions where if it's high for some particular
18 initiator but low overall, the IDP can consider that.
19 But basically it's a one-way gate. If it's presented
20 high, they can confirm that. If it's low, they can
21 either confirm that or decide to make it high for any
22 reason they choose.

23 DR. DIMITRIJEVIC: But also in this case,
24 Steve, what is happening is that what is not in PRA
25 would be assumed to be LSS, to go there to be decided

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1 on. And this wasn't done in this example because we
2 did not really look in anything which was not in the
3 PRA. So that why, actually, the population moved up,
4 instead of down --

5 MR. DUBE: Yes. I mean, that was my point
6 about the --

7 DR. DIMITRIJEVIC: -- in the low, in the
8 low.

9 MR. DUBE: -- the million components minus
10 2,000 is that they're on the low track there until
11 decided to bump up. And so if it were decided to
12 extend 50.69 to that whole population that's not in
13 the PRA, that's a lot of work to do. And so, you
14 know, it's a judgment call. I mean, it's a
15 cost-benefit trade-off between putting in the effort
16 to evaluate and changing the categorization of this
17 equipment versus what does one gain from it.

18 MEMBER SCHULTZ: That is very helpful.
19 Thank you.

20 MR. DUBE: So, moving along, I'm going to
21 really go quickly. You know, the ESBWR, GE-Hitachi
22 discussed the results. In some ways, the results in
23 terms of the distribution were similar to the active
24 pressurized water reactor, same magical 2,000
25 components, rather than the PRA. It's not a law of

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1 nature, but it turns out to be not too far off.

2 They did the sensitivity study to look at
3 the number of components that would be categorized as
4 low safety significance in the safety-related group.

5 MEMBER SHACK: Did they change their
6 criteria, the way they did for the DRAP program?

7 CHAIR STETKAR: They applied the same
8 criteria as they did for the DRAP program. And that's
9 what I want to ask the staff about.

10 MR. DUBE: Okay.

11 CHAIR STETKAR: Because when we get into
12 the Commission paper, you -- well, we'll talk about
13 the Commission paper this afternoon. So let's leave
14 it for that.

15 It's my understanding that ESBWR, I mean,
16 when you preface it for the record that currently
17 operating plants and the active new-builds that I'm
18 aware of have applied numerical criteria for the PRA
19 of Fussell-Vesely important greater than .005, risk
20 achievement worth of greater than 2, and common cause
21 risk achievement worth of greater than 20 for their
22 determination of risk, RISC-1 versus RISC-3 and RISC-2
23 versus RISC-4.

24 MR. DUBE: ESBWR did, yes.

25 CHAIR STETKAR: Safety significance.

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1 ESBWR uses Fussell-Vesely importance of greater than
2 .01, a factor of 2 higher; risk achievement worth
3 greater than 5, a factor of 2 and a half higher; and
4 common cause failure risk achievement worth of greater
5 than 50, a factor of 2 and a half higher. Therefore,
6 they are not using consistent measures of safety
7 significance.

8 MEMBER CORRADINI: Different measures.

9 CHAIR STETKAR: They are not using
10 consistent measures of safety significance. They are
11 using much broader acceptance criteria. And,
12 therefore, their populations of equipment in RISC-1
13 and RISC-2 are affected by that numerical value, are
14 smaller than they would be if they applied the numbers
15 that everybody else is using.

16 MR. DUBE: Right.

17 CHAIR STETKAR: Why is the staff
18 comfortable with that? And why is the staff
19 comfortable with that is question number one. If the
20 staff is comfortable with that, why shouldn't the
21 regulations -- regulatory guides, not regulations, be
22 changed to embrace that notion so that they can be
23 used uniformly by all new-build plants, not only the
24 ESBWR in isolation because there is some sort of
25 special case.

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1 MR. DUBE: Right.

2 MEMBER CORRADINI: Good question. Who are
3 you going to get to answer that one?

4 MR. DUBE: I have a man on deck there
5 because this was a comment in response to the original
6 Commission paper back in SECY-10-0121.

7 MEMBER CORRADINI: I'll bet you I know who
8 it is.

9 MR. DUBE: I'm going to call upon -- you
10 know, I have three help lines.

11 (Laughter.)

12 MR. DUBE: -- Todd Hilsmeier, who --

13 MEMBER CORRADINI: This is not surprising.

14 MR. DUBE: -- can directly answer this
15 one.

16 MR. HILSMEIER: My name is Todd Hilsmeier
17 from NRC Office of New Reactors.

18 And could you repeat your question again?

19 (Laughter.)

20 MR. HILSMEIER: I was in a happy space.

21 CHAIR STETKAR: It is kind of a two-point,
22 is why kind of in an absolute sense does the staff
23 accept the ESBWR's use of different numerical
24 importance measures compared to what are currently
25 being used in the current operating fleet and by other

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1 new-build plants. So that is in an absolute sense.

2 MEMBER SHACK: Not the ABWR.

3 CHAIR STETKAR: Not the -- I said
4 "current." I'm pretty careful sometimes.

5 MEMBER CORRADINI: But it's clear from the
6 explanation standpoint the ABWR sits in the same
7 category.

8 CHAIR STETKAR: ABWR, yes. But, in
9 particular, EPR and US-APWR do not. And, actually,
10 ABWR as it is being applied for the current
11 in-progress COL does not because the COLA applicant,
12 COL applicant for the ABWR is using what's called the
13 commonly applied numerical screening values. So, even
14 though in the design certification for ABWR they are
15 anomalous, the applicant is using the lower value.

16 So why is the staff comfortable with that?
17 That is one question. If the staff is comfortable
18 with that -- and you must because the design is
19 certified. And we have raised this question before.

20 MR. DUBE: Not quite yet certified.

21 CHAIR STETKAR: Yes. I'm sorry. I'm
22 sorry. Thank you. It's nearly there. This is not
23 the point of contention on that design certification.

24 If the staff is comfortable with that
25 difference, that is a philosophical difference, if I

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1 will, because now for this one particular new reactor,
2 the staff has accepted essentially a sliding scale on
3 those relative risk metrics --

4 MR. DUBE: Right.

5 CHAIR STETKAR: -- to determine risk
6 significance. And if the staff has accepted that, you
7 agree with that, why is that not part of your
8 Commission paper in terms of options to the
9 Commission? We will discuss that this afternoon, but
10 I might as well get it out this morning.

11 It's not mentioned in the Commission
12 paper. It only says, well, because the 50.69 process
13 consistently uses relative risk, we don't need to say
14 anything about that. The process as it's applied
15 works okay. But it doesn't consistently apply
16 relative risk. We have examples where it is
17 inconsistently applying those measures.

18 Those are my questions basically. Number
19 one, if you buy into the process that was used for
20 ESBWR, if you do.

21 MR. HILSMEIER: First, for the ESBWR, they
22 use reg guide 1.174 to justify their RAW threshold
23 corduroy of five. This is in I believe it is appendix
24 A of reg guide 1.174. It says that the RAW and
25 Fussell-Vesely threshold criteria should be a function

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1 of baseline CDF, instead of the same for every plant.
2 And so since the ESBWR has a lower baseline CDF, they
3 used a higher RAW and Fussell-Vesely criteria.

4 MEMBER CORRADINI: So they have bought
5 into a sliding scale?

6 MR. HILSMEIER: Correct.

7 MEMBER CORRADINI: Okay.

8 MR. HILSMEIER: And for RAW 5, if a plant
9 has a RAW of 5 and is failed, the CDF would increase
10 from 1E-8 to I believe 5E-8, so about 1E-7 delta CDF
11 while in reg guide 1.174 and for current operating
12 plants, acceptable delta CDF if 1E-6. And so with a
13 RAW of 5 for ESBWR, there is a smaller delta CDF, much
14 less than the 1E-6 in the reg guide 1.174 --

15 MEMBER CORRADINI: For internal events at
16 power.

17 MR. HILSMEIER: Excuse me?

18 MEMBER CORRADINI: For internal events at
19 power?

20 MR. DUBE: Yes.

21 MR. HILSMEIER: Yes, correct.

22 MR. DUBE: But event the external events
23 have --

24 MR. HILSMEIER: Yes. They looked at
25 external events, too.

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1 MEMBER CORRADINI: Maybe John is going to
2 go there, but he is just clever. So what you are
3 really saying is staff has already ad hoc developed a
4 sliding scale philosophy for design certification. So
5 why hasn't staff accepted that sliding scale
6 philosophy for solving this problem? I mean, am I
7 missing something?

8 MR. HILSMEIER: No. It's just -- as I
9 said during the ACRS meeting on ESBWR, we could not
10 say that their method was not appropriate. And I did
11 agree with their approach. I mean, I thought it was
12 acceptable.

13 MEMBER BLEY: So you are also saying any
14 applicant could go to 1.174 and make the argument.

15 CHAIR STETKAR: Well, but you're saying,
16 if that's true, why not build it in here? If that's
17 true, why not build it in here and at least provide
18 some coherence in terms of what that sliding scale is?

19 Because if I'm now applicant X with a
20 completely different design -- let's not get into
21 ESBWR or any of the current, I might say, "Well, okay.
22 I'm going to use a Fussell-Vesely importance of 7 and
23 a risk achievement worth of 600."

24 And will the staff then now need to
25 evaluate on a per-case basis each of those numbers to

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1 determine whether they're applicable or should there
2 be some general guidance, regulatory guidance, saying,
3 "Here is the sort of sliding scale that the staff
4 deems appropriate"? What are those risk-significant
5 values as a function of baseline CDF and LERF?

6 MR. DUBE: Good points. We have this
7 competition here between this statement, which
8 reaffirms the existing goals and metrics and the
9 bottom bullet, which says, "Okay. Enhanced margins
10 that ESBWR has should be available for operational
11 flexibility, design flexibility." And so this would
12 be where this competition is, if you will.

13 There is nothing in the regulation that
14 says risk achievement this, Fussell-Vesely this. It's
15 in the guidance. And guidance is guidance, which is
16 we start from this framework and the expression is
17 license applicant proposes and staff disposes.

18 So I'm not sure, number one, we have to
19 tie the hands of the applicants. Number two, as Todd
20 mentioned, there is this guidance in the reg guide
21 1.174 that allows some variation depending on the
22 baseline core damage frequency.

23 I mean, I can say from our old charter,
24 which is to look at the processes, the risk-informed
25 processes, and say, because of this, is there

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1 potential for significant decrease in the enhanced
2 level of safety of any particular plant, ESBWR,
3 because they use thresholds that are a factor of two
4 different than some of the other plants, active
5 plants, when their baseline core damage frequency is
6 at least an order of magnitude different? I mean, the
7 answer to that is staff feels comfortable that there
8 is no decrease enhancing level of safety just because
9 of different thresholds.

10 CHAIR STETKAR: Suppose the baseline core
11 damage frequency is 10-6.

12 MR. DUBE: And?

13 CHAIR STETKAR: Suppose it was 10-6, still
14 well below currently operating plants but a factor 100
15 higher, and they came in with their risk significance
16 values. Is that okay?

17 MR. DUBE: We would take a look at it.
18 And it might not be.

19 MEMBER CORRADINI: But your answer, then,
20 implies what John was asking before, which is you are
21 okay in this case, but until somebody else brings you
22 a different RAW, you are not sure you will be okay in
23 the next case. That's what I just heard.

24 MR. HILSMIEIER: Yes, I agree with that.

25 MEMBER CORRADINI: So, I mean, maybe John

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1 has brainwashed me here, but I guess that strikes me
2 as develops a level of uncertainty for the incoming
3 applicants that is necessary. Why is that necessary?
4 Why is that? It seems to me in some sense you have ad
5 hoc developed a logic which I personally like. Why
6 not codify it and explain it to create certainty and
7 some understanding in the industry?

8 CHAIR STETKAR: Such that if I come in
9 with 3 times 10-6, I at least know that okay. Here is
10 roughly the range of values that I should interpret as
11 staff's knowledge of risk-significant.

12 MEMBER CORRADINI: Right. I know we
13 brought John over on this one because I don't remember
14 him being so happy during the ESBWR times. But I
15 think your explanation to me makes sense. Then that
16 leads to the fact that -- and you actually have
17 developed a thinking philosophy that ought to be --
18 I'll use the word "codified" but at least explained so
19 industry knows going in what to expect.

20 MR. HILSMIEIER: Yes. In my personal
21 opinion because under maintenance rule, there is a
22 risk significance methodology, methodology for
23 defining risk significance under 50.69 space. There
24 is a slightly different methodology for defining risk
25 significance.

1 CHAIR STETKAR: In our guidance, there are
2 different numbers.

3 MEMBER CORRADINI: John has educated us on
4 all of this.

5 MR. HILSMEIERS: Right. In my personal
6 opinion, since risk significance is used so much, it
7 would be nice to have a general guidance document to
8 define risk significance.

9 Another point I want to make is per the
10 design centers with very low CDF and LRF, they use a
11 RAW of two, Fussell-Vesely of .005. And their
12 risk-significant list is very, very large. And it may
13 mask the really important risk-significant SSCs.

14 MEMBER SHACK: So, on the other hand, it
15 sort of puts an importance on the bottom line numbers
16 that could be -- would Tippen Point, for example, with
17 10⁻⁷ CDF suddenly qualify for a 50.69 process
18 equivalent to an AP1000?

19 You know, the industry is willing to live
20 with these numbers for the maintenance rule in 50.69.
21 I would be a little reluctant to let the staff deal
22 with them on a case-by-case basis, but you could make
23 --

24 CHAIR STETKAR: On the other hand, Bill,
25 this is for a risk-informed application. You ought to

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1 have a PRA that satisfies the quality requirements of
2 reg guide 1.200. So if the PRA spoke level of detail,
3 quality, data, yadda yadda yadda, satisfies those
4 requirements, then, you know, if that's the number,
5 that's the number.

6 I'm skeptical, I'm always skeptical, of
7 small numbers. And if they don't quantify
8 uncertainty, there is real reason for skepticism. But
9 as long as they can show the PRA doesn't have any
10 fundamental flaws in it, then you ought to use it as
11 a quantification tool. And that takes the metrics out
12 of it.

13 If you use a meter stick to try to measure
14 fractions of a millimeter and the scale was not all
15 that well-developed, you ought not to use that scale.

16 MR. DUBE: One final word on -- Biff
17 Bradley was --

18 MR. BRADLEY: Biff Bradley.

19 Just a very minor point, a clarification.
20 What we have been talking about is the RAP, not 50.69.
21 ESBWR is not implementing 50.69. I understand the
22 philosophy is the same. It's not directly -- there is
23 no operating plant RAP. So this isn't a new plant
24 versus old plant guidance issue.

25 This is a little different from 50.69. I

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1 would expect if a new plant were to implement 50.69,
2 they would get the same importance measures that we
3 have in the guidance for the operating plant. It
4 wouldn't be different, just to clarify.

5 CHAIR STETKAR: Well, Biff, be careful
6 because I have raised this question with one of the
7 COLA applicants that as they transition, for example,
8 from the certified design into their maintenance rule
9 program, you know, are they going to then apply the
10 operating types of numerical values and suddenly
11 expand the list of equipment that's under the
12 maintenance rule compared to that set of equipment
13 that was in the certified design using the different
14 methods. And that can result in a discontinuity as
15 you go from the design certification to the operating
16 programs.

17 MR. BRADLEY: It may. I don't think
18 there's anything in our maintenance rule guidance that
19 lets you go out of the normal factors for those
20 importance measures.

21 CHAIR STETKAR: There isn't at the moment.

22 MR. BRADLEY: Right. And certainly 50.69,
23 the importance measures are just a minor part. I
24 mean, there's like --

25 CHAIR STETKAR: Yes.

1 MR. BRADLEY: -- 100 pages of guidance.
2 So they don't know how to categorize. But it's not my
3 expectation that new plants would use different values
4 than the ones that we have listed there. If they did,
5 I think they would have to come in and make that case.

6 CHAIR STETKAR: But, I mean, you do get
7 this kind of philosophical difference that those four
8 categories, although we're particularly looking at
9 50.69 in the slides here, risk-significant things
10 under 50.69, the argument has already been made by the
11 staff that RTNSS or DRAP looks like RISC-2 under
12 50.69. So I don't understand numerical
13 discontinuities simply if we're talking about 50.69
14 for a new plant or RTNSS or DRAP for --

15 MR. BRADLEY: There would be other
16 discontinuities because RTNSS or DRAP are based solely
17 on those importance measures. And 50.69 has got 100
18 other things we have got to consider. So you are
19 going to have all of these qualitative considerations,
20 EID and other things, that are different from the
21 criteria for RAP.

22 CHAIR STETKAR: I thought at least DRAP
23 goes through the --

24 MR. BRADLEY: It may have other criteria.

25 CHAIR STETKAR: -- qualitative -- I'm just

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1 saying decision-making. I'm not sure about the --

2 MR. DUBE: It is not as formal as
3 regulatory requirement.

4 CHAIR STETKAR: I know we have talked to
5 applicants. And they claim that they're applying that
6 type of qualitative panel. So, again, it's sort of
7 philosophically the same, perhaps not as well-defined.

8 MEMBER BLEY: It hasn't come up really
9 operational yet.

10 CHAIR STETKAR: No, it hasn't. Well,
11 that's one of the reasons for raising questions now,
12 to get a bit ahead of the curve.

13 MR. DUBE: So, in conclusion --

14 (Laughter.)

15 MR. DUBE: Remember, our charter was not
16 to solve world hunger, but --

17 MEMBER CORRADINI: It wasn't? It wasn't?

18 MR. DUBE: -- a series of tabletops that
19 test existing guidance specifically, though, to
20 identify where there was the potential for significant
21 decrease in the enhanced level of safety as a result
22 of new reactor risk profiles.

23 And the staff reached a conclusion on
24 50.69 that based on the limited sizes and the limited
25 comparison with the ones that result from South Texas

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1 1 and 2, that there are no gaps, there are no
2 considerations other than risk that factor into the
3 categorization. We're showing a diagram where
4 considerations impact on design basis accident
5 analysis, defense-in-depth, margin of safety taken
6 into consideration.

7 And specifically with the concern being on
8 RISC-3, which are the safety-related but low safety
9 significance, it's actually codified in regulation
10 what has to be considered in terms of performance
11 monitoring, addressing any failures in the Corrective
12 Action Program, and taking appropriate action that,
13 specifically for 50.69 stuff, is not performing any
14 changes to the guidance.

15 MEMBER BLEY: Let me go back to world
16 hunger just a second. The arguments we have been
17 making around the table about we're talking the
18 specificity on how this so-called sliding scale ought
19 to work for component performance strikes me as one of
20 those places where suddenly we get every different
21 aspect of regulation gets its own set of guidance with
22 its own sliding scales. Wouldn't the appropriate
23 place if you want to see this more formalized be back
24 at 1.174 --

25 CHAIR STETKAR: Sure.

1 MEMBER BLEY: -- so that we don't have it
2 scattered all over the place?

3 CHAIR STETKAR: Sure.

4 MEMBER BLEY: That would just be
5 worrisome.

6 CHAIR STETKAR: You know, I certainly
7 think that's to do it as long as everything else
8 points to 1.174.

9 MR. DUBE: And they all do pretty much,
10 yes.

11 CHAIR STETKAR: They all do pretty much.
12 So yes.

13 MR. DUBE: I mean, it's the --

14 CHAIR STETKAR: That would be the
15 fundamental guidance doctrine, I suppose.

16 MEMBER BLEY: I just didn't want anyone
17 leaving here thinking we want to see this guidance
18 fragmented.

19 CHAIR STETKAR: No. I mean, I think that
20 is why we are where we are is that we have different
21 guidance for different focused purposes and numbers
22 have evolved --

23 MEMBER BLEY: Right.

24 CHAIR STETKAR: -- for each of those sets
25 of guidance. And in many cases, the numbers are

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1 generally consistent. But in a few cases, there is
2 room for different interpretations.

3 MR. DUBE: I understand your point. It is
4 well-taken. From that viewpoint, maybe there is the
5 possibility of making some enhancements to the
6 guidance, but from the viewpoint of is a factor of two
7 on the threshold for risk achievement work going when
8 applied to the ESBWR going to result in a significant
9 decrease in the enhanced level of safety of the
10 design? I would say no.

11 CHAIR STETKAR: Yes. I understand. I
12 don't think any of us are arguing -- you know, at that
13 level of specificity, --

14 MR. DUBE: Yes.

15 CHAIR STETKAR: -- we are looking at sort
16 of consistency in the whole process as it's applied,
17 current operating reactors in the context of 50.69, in
18 principle, to new reactors if they were going to adopt
19 50.69 or to new design certifications for reactors
20 that we haven't even thought about yet coming forward
21 that might have wildly different core damage
22 frequencies, different risk contributors, things like
23 that -- we sort of have a shot at working on this
24 problem now.

25 MR. DUBE: That's a lot of what I had to

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1 say on 50.69. That's as much as it --

2 CHAIR STETKAR: You didn't think you were
3 going to get out of saying less, though, did you?

4 MR. DUBE: Any other comments from any of
5 the members on 50.69? No? Okay.

6 MEMBER SKILLMAN: I do. On your Slide 9,
7 please, where do the fire systems reside?

8 MR. DUBE: Fire protection system, you
9 usually have the wrong quality assurance program
10 because they're not credited in a chapter 15 accident
11 analysis, for example. I think it's fair to say that
12 they're in the right-most column. So it's either a
13 two or a four, I would think.

14 MR. BRADLEY: That is correct. It's
15 typically important to quality. So they can be
16 RISC-1-ish or RISC-2-ish.

17 I think with the fire PRAs now that we are
18 having to live with, you are going to see on plants
19 like Vogtle some fire SSCs show up in RISC-2.

20 We're actually struggling a little bit
21 with Vogtle right now because of what we believe are
22 conservatisms in the fire PRA. And the impact on the
23 denominator as well for the importance measures is
24 causing us some concern right now. But fire systems
25 typically right now are not safety-related. They're

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1 important to safety.

2 CHAIR STETKAR: And I believe, Biff, for
3 new plants, when you look at DRAP -- and I know you
4 remember these things better than I do. Fire
5 protection systems are explicitly called out as one of
6 the sets of systems that you need to look at for DRAP,
7 aren't they? I mean, there are those. Are they or
8 are they not?

9 MR. BRADLEY: That I can't --

10 CHAIR STETKAR: Well, there's a set of --
11 station blackout, ATWS, and fire protection I think
12 are called out explicitly.

13 MR. BRADLEY: That's extremely dangerous.

14 CHAIR STETKAR: I was hoping you would
15 remember because it's been --

16 MR. DUBE: Todd Hilsmeier might be able to
17 answer with a great degree of confidence.

18 CHAIR STETKAR: Todd, I know it's not
19 50.69, but, again, in the sense that this box sort of
20 seems similar.

21 MR. HILSMEIER: Yes. My name is Todd
22 Hilsmeier again.

23 Yes. The fire water pumps are generating
24 DRAP. It depends on the design in DRAP for alternate
25 injection into the reactor vessel. I'm thinking for

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1 like STP --

2 MR. DUBE: Three and four.

3 CHAIR STETKAR: Right.

4 MR. HILSMEIER: Yes, three and four.

5 MR. DUBE: ABWR.

6 MR. HILSMEIER: Yes.

7 CHAIR STETKAR: But not necessarily for
8 the fire protection functions? I can't honestly
9 recall. This is not a leading question.

10 MR. HILSMEIER: Right.

11 CHAIR STETKAR: This is trying to see if
12 we can get a little more information into Dick's
13 question for at least new plants.

14 MR. HILSMEIER: It's a fire PRA model of
15 credits. It would like --

16 CHAIR STETKAR: Yes. That certainly would
17 be pretty clear.

18 MR. HILSMEIER: And also, I mean, it
19 depends on the expert panel. The expert panel --

20 CHAIR STETKAR: Yes.

21 MR. HILSMEIER: -- may also add the fire
22 protection system for fire suppression. I think, for
23 one, the design centers that I'm reviewing, they
24 included fire protection pumps for fire suppression.

25 CHAIR STETKAR: Okay. Thanks.

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1 MEMBER SKILLMAN: Biff, if I could ask
2 you, based on a comment that you made just a minute
3 ago that there was some difficulty in determining the
4 categorization of the fire equipment, would you expand
5 on that a little bit? Is this an economic
6 consideration or is this a philosophical
7 consideration?

8 MR. BRADLEY: It is not really an economic
9 consideration. We have briefed this Subcommittee
10 previously over the last couple of years about some
11 concerns we have about conservative bias in fire PRA.
12 Some of this is a state of knowledge kind of
13 challenge. Other is some regulatory elements that
14 desire conservatism in these models for the 805
15 applications.

16 So we believe we developed fire PRAs that
17 may have some bias with respect to the other model
18 we're using; for instance, internal events at Vogtle
19 for categorization. So we want to make sure we can
20 properly account for that bias and that is not
21 negatively impacting the categorization result.

22 And we didn't anticipate I think when we
23 wrote 00-04 that -- this was one problem that we
24 didn't explicitly address in the guidance. And now
25 we're coming back to look at that.

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1 But we understand for the 805 application
2 the staff desires conservatism directly in the PRA for
3 various reasons, but when you try to use that PRA for
4 other purposes, especially when you're comparing it
5 with your internal events risk and trying to make a
6 decision based on that combined risk, then it gets a
7 little more challenging. And that's what we're
8 dealing with right now at Vogtle. That's what I was
9 referring to.

10 MEMBER SKILLMAN: Thank you, Biff.

11 MR. BRADLEY: Sure.

12 MEMBER SKILLMAN: Thank you.

13 CHAIR STETKAR: Any other questions or
14 comments among the members for 50.69?

15 (No response.)

16 CHAIR STETKAR: If not, we're going to
17 take a break. So we will recess until 10:15.

18 (Whereupon, the foregoing matter went off
19 the record at 9:59 a.m. and went back on the record at
20 10:15 a.m.)

21 CHAIR STETKAR: We are back in session.
22 Let's hear about 1.174.

23 MR. DUBE: Okay. We had an interesting
24 workshop, tabletop exercises on October 5th on 1.174.
25 And I'll just at a high level discuss what we did and

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1 what was the outcome.

2 Recollect there are five basic principles
3 in reg guide 1.174. This is the risk-informed license
4 amendment request. And specifically these five
5 principles, as stated in reg guide 1.174, are
6 generally applicable to all risk-informed initiatives.
7 The proposed change meets regulations unless it's
8 specifically asking for an exemption consistent with
9 the defense-in-depth philosophy.

10 And, as an aside, reg guide 1.174 -- and
11 you'll probably see it -- has been revised. It's
12 going through the final concurrence process. But
13 there was a task to provide more discussion in a
14 hierarchical delineation of defense-in-depth and with
15 examples. So that is being beefed up.

16 Maintains sufficient safety margins,
17 results in an increase in CDF or risk that is small
18 and consistent with the Commission's Safety goal
19 policy statement, then monitor the performance going
20 forward.

21 Again, these are the risk-informed
22 acceptance guidelines; whereas, on the upper right is
23 the core damage frequency. On the lower left is large
24 early release frequency.

25 And the x-axes of both are the baseline

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1 core damage frequency representing theoretically the
2 total core damage frequency as much as it is
3 quantified as possible. On the y-axis are as a result
4 of the change, some measure of the change of core
5 damage frequency that might result as a result of the
6 proposed implementation of the license amendment.

7 Region I are regions where the no changes
8 would be allowed. Region II says, "Well, you know,
9 they're allowed, but there should be a good,
10 compelling reason why." And region III and below is
11 where most of the change historically has taken place,
12 the license amendments have been proposed.

13 Now, again, early on in this project we
14 looked at what options might there be should new
15 reactors have different thresholds for regions I, II,
16 and III. And, of course, the Commission SRM said no.
17 So this plot is not going to change, certainly not as
18 a result of our response to the SRM.

19 So what we did do in the tabletop is we
20 hypothesized eight different cases, exercising pretty
21 much the full range of the new reactor designs. And
22 they were hypothetical but reasonable. They were
23 hypothetical in the sense of what if the ESBWR
24 proposed the change that would have this kind of an
25 impact on core damage frequency or large release

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1 frequency, large early release frequency.

2 And we weren't so much interested in the
3 numerical value and where it was on this plot so much
4 as what is the staff's thought process, what has it
5 been for the current fleet, and then if we carry this
6 over to the new fleet, what would be the staff's
7 process and what would be some considerations that
8 might come into play to be sure that the enhanced
9 level of safety of the new design was not weakened.

10 And so I view these guidelines or filing
11 in the region III or typically the low range of region
12 II as necessary but not sufficient conditions. In
13 other words, those principles are a series of
14 principles. These are and between typically and not
15 or. So the risk change can be small, but once there,
16 they have to maintain defense-in-depth and have to
17 maintain safety margins.

18 So we did a number of exercises. I'm not
19 going to go through the eight cases that would have
20 been in your background material that was handed out.
21 I will take one example here. On the ABWR. Again,
22 this is just a hypothetical case to exercise the
23 thought process on how the staff and industry would
24 respond to this kind of a change.

25 So here in the ABWR, we are proposing

1 hypothetically that a change was proposed to the
2 containment over-pressurization system, which is the
3 wetwell venting, to reduce the rupture disk setpoint
4 from 104 psia to some lower value and change 2
5 isolation valves from normally open to normally closed
6 with operator action required for venting.

7 So in the current design that has been
8 certified, there are two isolation valves. But they
9 are normally open. And they are too isolated in the
10 event that decision was made, for whatever reason,
11 that needs to stop making releases.

12 Basically it's a passive design with
13 actually two ruptured disks: one ruptured disk at 104
14 psia. And the second is just there against protection
15 against pigeons coming into the vent line that's going
16 out to the atmosphere. And it's entirely passive in
17 nature. And there's nothing right now as it's
18 currently designed the operator needs to do.

19 We're just hypothesizing what if a change
20 were made, for whatever reason, and it had this kind
21 of order of magnitude.

22 CHAIR STETKAR: Don, do you happen to know
23 off the top of your head, just out of curiosity, what
24 percentage change that was in core damage frequency?
25 Do you remember what the baseline --

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1 MR. DUBE: Well, this is -- and this is
2 roughly kind of a number that it might result from
3 this of a change.

4 CHAIR STETKAR: I understand. Were you
5 starting from 10-3 or --

6 MR. DUBE: Oh, the internal events core
7 damage frequency of the ABWR is somewhere in the 3 to
8 4 times 10-7 range.

9 CHAIR STETKAR: So it's about 25 percent
10 roughly. Okay. Thanks.

11 MR. DUBE: So it would lie right here at
12 the bottom level of region III. In fact, you know,
13 10-7 here for a reason, but it would be -- and
14 vertically it would be right at the bottom of that
15 graph.

16 And I show two X's there. And that's
17 because since we don't have a seismic PRA for ABWR, I
18 hypothesized a range of what the seismic CDF might be.
19 And I show a range of what is the baseline CDF might
20 be, plus or minus about an order of magnitude.

21 So this was a good example where the risk
22 is small. It's in the lower region, lower end of
23 region III. So in terms of the principles, would one
24 conclude that the risk increase is small? The answer
25 is yes. But those are the factors, such as

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1 defense-in-depth.

2 And one of the elements of
3 defense-in-depth is does one possibly defeat or
4 exchange a passive function with an active function?
5 And, therefore, a situation where there was
6 essentially very little operator error unless one
7 assumes operator error of commission to isolater, but
8 aside from that, to substitute a passive function with
9 an active function is not in keeping with one of the
10 elements of defense-in-depth. And this is a situation
11 probably where unless there was an extremely strong
12 compelling reason, staff probably for defense-in-depth
13 reasons would not approve this license amendment.

14 MEMBER SKILLMAN: So this is just a
15 hypothetical situation.

16 MR. DUBE: Yes, no one is claiming --

17 MEMBER SKILLMAN: All right. Okay.

18 Thanks.

19 MR. DUBE: And all of these eight examples
20 were that, and some people got nervous. We wouldn't
21 do that, but it wasn't so much to, as I said, in all
22 of these examples, to, say, "Is it realistic?" and
23 "Would someone do that?" It is to exercise the
24 thought process. So in all of these examples, we
25 exercise a number of considerations.

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1 Am I up to here already?

2 CHAIR STETKAR: Don't feel bad about
3 getting ahead of the curve.

4 MR. DUBE: Okay. So in all the examples,
5 we observed the change in core damage frequency risk
6 to be low, but what we saw in all of these examples is
7 that there often were these other principles that
8 would come into play.

9 And, again, I will emphasize small risk
10 increase is necessary but not sufficient. In a lot of
11 these examples that we hypothesize, there would be
12 everything from substituting active function for what
13 was previously passive or degrading defense-in-depth
14 and that possibly removing equipment from service that
15 provides a defense-in-depth for high-pressure
16 injection, low-pressure injection, or
17 loss-of-feedwater events might come into play.

18 And in all of the examples that we went
19 through, we saw the theme where defense-in-depth
20 really had an active role in all of these
21 considerations and under the staff's current reasoning
22 would prevent a number of changes that based on just
23 risk numbers are quite small but defense-in-depth
24 played an important role.

25 MEMBER ARMIJO: Don, could you go back to

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1 your example on the ABWR change? I would want to
2 understand exactly the reasons why that particular
3 change would not have been accepted. If you take two
4 active valves which are normally and then you --

5 CHAIR STETKAR: Close them and make an
6 operator --

7 MEMBER ARMIJO: You have to have an
8 operator action. So you --

9 MR. DUBE: To open those two valves.

10 MEMBER SHACK: So he could fail to do it.

11 MEMBER ARMIJO: Okay. Okay. Okay. I
12 read it the other way around. They were normally
13 closed. Okay. So in this case, you would have to
14 have an active --

15 MR. DUBE: Right. You are relying on --
16 you know, the design certification and reflecting the
17 combined license application was reviewed by the
18 staff. And the design was certified based on passive
19 heat removal function as a last, one of the last,
20 measures and substituting now requiring operator
21 action for what was previously approved passive would
22 probably get very close scrutiny by the staff.

23 MEMBER ARMIJO: But it wasn't related to
24 the reduction in the setpoint on the disk rupture.

25 MR. DUBE: No.

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1 MEMBER ARMIJO: It was related to the
2 valve --

3 MR. DUBE: Yes.

4 MEMBER ARMIJO: -- being normally open and
5 all this?

6 MR. DUBE: Right.

7 MEMBER ARMIJO: Okay. I understand it
8 now. Thanks.

9 MR. DUBE: Thank you.

10 So we did these eight exercises and then
11 looked at 1.174 in general. And I know, aside from
12 the issue of reg guide 1.174 should have some guidance
13 on risk importance measures, the staff concluded that
14 there were no gaps in the reg guide 1.174 from the
15 viewpoint of line tape in reg guide 1.174 in those
16 five principles that have been used quite successfully
17 for current operators for current reactors and apply
18 them to new reactors. And the answer was yes, the
19 staff does not feel that using the existing guidance
20 and applying it, considering those five principles,
21 would result in a decrease in enhanced level of safety
22 of the new reactor designs.

23 CHAIR STETKAR: And, Don, was that
24 conclusion basically uniform for your eight examples
25 in terms of the staff's judgment regarding

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1 defense-in-depth or some of those other qualitative
2 measures being the -- I don't want to call it the
3 backstop that would --

4 MR. DUBE: Yes. I mean, I think we felt
5 comfortable in all of those examples.

6 MEMBER ARMIJO: If it wouldn't take too
7 much time, do you have an example that you accepted as
8 a backup slide, one of these changes, just to
9 calibrate me on --

10 MR. DUBE: You know what?

11 MEMBER ARMIJO: Even if you don't have a
12 slide, maybe you could just describe it.

13 MR. DUBE: Well --

14 CHAIR STETKAR: I don't immediately recall
15 any.

16 MEMBER ARMIJO: Like I said, I didn't see
17 any.

18 MR. DUBE: Either enclosure 3 or enclosure
19 4.

20 PARTICIPANT: It's not 4. Four was the
21 ROP.

22 CHAIR STETKAR: Four is the ROP. It's not
23 in those enclosures, Don.

24 MR. DUBE: You don't think so?

25 CHAIR STETKAR: Well -- oh, wait a minute.

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1 MR. DUBE: I believe it was that --

2 CHAIR STETKAR: I think it was in the ROP
3 because it was rolled up in that same meeting, wasn't
4 it?

5 MR. DUBE: It was in the material that you
6 had.

7 CHAIR STETKAR: Yes. It was in the
8 material that we had, but I have renamed all of my
9 files.

10 MR. DUBE: Oh, great. We're on the wrong
11 --

12 CHAIR STETKAR: Well, you can rotate.
13 Here it is.

14 MEMBER SIEBER: Either way down or --

15 MR. DUBE: Change this. Rotate clockwise.

16 CHAIR STETKAR: Just keep that.

17 MR. DUBE: Clockwise. So this is the
18 handout. This was the activity.

19 CHAIR STETKAR: And we had this material.

20 MR. DUBE: Yes, yes.

21 CHAIR STETKAR: So you can read it.

22 MR. DUBE: This might be --

23 MEMBER ARMIJO: Okay. So here is an --

24 MR. DUBE: This might be an example that
25 we -- this was actually pretty close to an actual

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1 example because early in the design phase because of
2 design basis accident considerations and concern of
3 what happens if there were a steamline break inside
4 containment and the impact on containment performance
5 and the need to isolate feedwater. This was actually
6 an early change that some of you probably are familiar
7 with.

8 The PRA influenced the actual modification
9 that was implemented. After they fine-tuned the
10 change, the change resulted in a core damage frequency
11 change of the order of 10^{-8} .

12 I note here that the core damage frequency
13 for all the quantified events and molds is around
14 10^{-7} . This does not include seismic. I assumed this
15 so we could get a baseline case.

16 We went through the thought process. And
17 I think for this particular change because what they
18 did was compensate for the need to isolate it by
19 providing a means of bypassing the isolation of
20 feedwater because the feedwater system provided some
21 defense-in-depth for decay heat removal.

22 MEMBER ARMIJO: They didn't substitute an
23 active system for --

24 MR. DUBE: Yes. It was in many ways, in
25 an actual event, you've got to cut back on feedwater

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1 or, else, you are grossly overflowing the reactor
2 vessel. So it was more or less an actor for an actor.
3 It was not an actual license amendment request, but we
4 used it as an example of what if --

5 MEMBER ARMIJO: Because this happened
6 during the certification.

7 MR. DUBE: Yes. This happened during the
8 certification.

9 MEMBER ARMIJO: Okay.

10 MR. DUBE: So this would have been an
11 example of where we felt comfortable with the change.

12 MEMBER ARMIJO: Okay. That kind of
13 calibrates me.

14 MR. DUBE: Good.

15 MEMBER ARMIJO: Thank you.

16 MR. DUBE: Well, where am I?

17 MEMBER SIEBER: Back to slide 21. If you
18 go back, let me ask you a question on the previous
19 one. You talk about changing from passive to active,
20 which means operator action. Do you take into
21 consider over time how many new operator actions you
22 add and what effect that has on the ability of the
23 operator to perform them without making errors?

24 MR. DUBE: Well, I mean, that should be a
25 consideration.

1 MEMBER SIEBER: It should be. The
2 question is, is it explicitly a consideration?
3 Because I can imagine as plant operation continues
4 over the years to make changes to move passive systems
5 to active systems because things don't work exactly
6 the way you want them to. And to me, you reach a
7 point where the operator just can't understand or
8 handle a whole bunch of things --

9 MR. DUBE: I understand why.

10 MEMBER SIEBER: -- that require his manual
11 actions.

12 MR. DUBE: It should be reflected in the
13 PRA. And the PRA is required -- for new reactors, it
14 is actually a requirement by regulation to be updated
15 and maintained and meet the standards that have been
16 endorsed by the staff. And the ASME/ANS standard has
17 a series of high-level and implementing requirements
18 on the human reliability analysis, including taking
19 into account dependencies across operator action. The
20 fact is that if you have several operator actions that
21 are not independent of each other; that is, one
22 operator action may be dependent on the other and how
23 you quantify it.

24 So the long and short of your answer is
25 the PRA that's maintained and maintained to the

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1 standards has to take that into account. And so if a
2 large number of dependencies of operator actions
3 eventually manifested themselves in exchange, it
4 should be captured by the PRA.

5 MEMBER SIEBER: Should be. And new
6 regulations require PRA to be up-to-date --

7 MR. DUBE: Yes.

8 MEMBER SIEBER: -- periodically? If so,
9 how often --

10 MR. DUBE: They have to maintain it
11 consistent with the degree of the change to reflect
12 current design and operational experience. No less
13 frequent than every four years they have to do an --

14 MEMBER SIEBER: You can do a lot of
15 changes in four years.

16 MR. DUBE: Yes, but they typically
17 accumulate. I mean, the way it's done is you have a
18 record and maintain a running list. And most
19 licensees have a threshold. You do a
20 back-of-the-envelope calculation. And there's a
21 threshold that if a core damage frequency might change
22 by some amount, I know at one particular licensee that
23 that is ten percent CDF. Then an update is going to
24 be required by procedure.

25 MEMBER SIEBER: Yes.

1 MR. DUBE: I mean, I used to do that. You
2 maintain a running list of what changes need to be
3 incorporated at the next update.

4 MEMBER SIEBER: I just want to make sure
5 all licensees do it.

6 MR. DUBE: Well, for new reactors, it's --

7 MEMBER SIEBER: What you're describing is
8 the responsible thing to do.

9 MR. DUBE: It's a requirement.

10 MEMBER SIEBER: Yes, for four years, long
11 tim.

12 MR. DUBE: That's true.

13 MEMBER SIEBER: Okay. Thank you.

14 MR. DUBE: So any questions on reg guide
15 1.174? We made up some time.

16 (No response.)

17 4. LRF TO LERF TRANSITION

18 MR. DUBE: The next topic is transition
19 from large release frequency to large early release
20 frequency. This is not in keeping with the other
21 exercises in the sense of, you know, this is not
22 really a risk-informed activity, but it's a
23 longstanding issue, which is -- you know, the new
24 reactors have been licensed using large release
25 frequency as a metric. And current operating fleet

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1 use large early release frequency in all of their
2 risk-informed applications and acceptance guidance and
3 the reactor oversight process.

4 And we're long overdue on addressing --
5 since the Commission directed us to use the same risk
6 metrics, the fact that new reactors have been using
7 large release frequency, how does one transition to
8 large early release frequency?

9 So we took it up as an exercise to look at
10 various options that one might use. And I'll go
11 through the options and staff's recommendations.

12 Basically a real quick history. The
13 Commission goals for new reactors, as you might
14 recall, are based on a conditional containment failure
15 probability of less than 0.1, large release frequency
16 of less than 10^{-6} and a 10^{-4} per year for core damage
17 frequency. Whereas, operating reactors use core
18 damage frequency and large early release frequency as
19 the primary risk metrics, those are used in reactor
20 oversight process in reg guide 1.174.

21 So some of the issues with continuing use
22 of large release frequency is -- well, issue number
23 one is these have not been defined by the staff. And
24 each design center has chosen a different definition.

25 Now, for the purpose of the staff's review

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1 of the design certification application, the COL
2 application, the determination of whether they met the
3 Commission's objectives, staff's been able to review
4 it, notwithstanding not having a universal definition
5 because all of the design certifications have chosen
6 very conservative definitions of a large release.

7 For example, ESBWR says anything more than
8 tech spec leakage through containment is a live
9 release. And that's sort of by orders of magnitude.

10 MEMBER ARMIJO: Yes. You can't do better
11 than that.

12 MR. DUBE: And, correspondingly, others
13 have used any release resulting in more than 25 rem at
14 site boundary as a --

15 MEMBER CORRADINI: Can you give me a few
16 other, can you repeat that example with a few other,
17 examples that show the other extreme? I mean, you
18 once did this I can't remember how many presentations
19 ago.

20 MR. DUBE: Right. Okay.

21 MEMBER CORRADINI: It was a good
22 illustration, but the range of extremes are anywhere
23 from anything above tech specs to --

24 MR. DUBE: Well, the worst, I mean,
25 there's exposure-based guidance, like 25 rem at the

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1 site boundary, like 0.5 or 0.6 miles, like a kilometer
2 or something like that.

3 MEMBER CORRADINI: Okay. Fine. That's
4 the other extreme.

5 MR. DUBE: And others have used a
6 containment failure mode-based definition of large
7 release being any kind of containment failure:
8 Containment bypass, containment isolation failure, or
9 any kind of large-scale containment failure other than
10 like basemat leakage. Some have even included basemat
11 leakage as part of a definition of large release. So
12 they generally have been pretty conservative.

13 MEMBER CORRADINI: Don, the reason I ask
14 that under your first bullet is -- oh, no. Let me
15 just wait. I'm sorry. Excuse me.

16 MR. DUBE: Yes.

17 MEMBER CORRADINI: I'm sorry.

18 MR. DUBE: Those are some of the issues.
19 So for the purposes of certifying a design and issuing
20 a combined license and meeting the Commission's
21 objectives, the fact that there is no universal
22 definition has not been an impediment, if you will, to
23 licensing requirements.

24 But, going forward, there are issues
25 because the ASME/ANS level 1 PRA standard, which the

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1 staff endorsed, uses large early release frequency.
2 And it's used, large early release frequency is used,
3 in risk-informed guidance, including reg guide 1.174,
4 and all the subsidiary guidance and the reactor
5 oversight process. So we add this discrepancy.

6 And then also no existing or proposed
7 level 2 PRA standard -- and I have reviewed the level
8 2 PRA standard -- provides a universal definition of
9 large release or large release frequency.

10 So we've got this dilemma of do we
11 perpetuate large release frequency going forward or do
12 we say at some point since the Commission directed us,
13 you know, move from one metric to another.

14 MEMBER ARMIJO: Don, just to make sure I
15 understand, for the ESBWR, does that mean LERF and LRF
16 are the same since it's anything other than this
17 leakage?

18 MR. DUBE: No. I wouldn't say they are
19 the same, no.

20 MEMBER ARMIJO: Then somewhere along the
21 line, you are going to have to explain what is going
22 on.

23 MR. DUBE: There's guidance in reg guide
24 1.174 on what has traditionally been used as large
25 early release frequency. There is also guidance in

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1 the ASME/ANS standard.

2 CHAIR STETKAR: Well, but I think what Sam
3 is asking is LERF in the particular application of
4 what ESBWR has called LERF is a subset of that.

5 MEMBER ARMIJO: It should be a precursor
6 to LRF.

7 CHAIR STETKAR: No. It's a subset of it,
8 right?

9 MR. DUBE: You would think it's a subset,
10 but about three years ago, Doug True from Erin
11 Engineering gave a presentation and says --

12 PARTICIPANT: We had a long talk about it.

13 MR. DUBE: -- in fact, it ends up being,
14 LRF ends up being, a subset of LERF.

15 PARTICIPANT: We will calculate that.

16 MEMBER CORRADINI: What?

17 MR. DUBE: Yes.

18 CHAIR STETKAR: Even if they have defined
19 it as any leakage above tech specs as being LRF?

20 MR. DUBE: Well, I can't speak on a
21 specific basis, but they use some calculations from
22 NUREG-1150 and showed that it was contrary to thought
23 process.

24 CHAIR STETKAR: That's true for the way
25 NUREG-1150 defined things, but Sam was asking in the

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1 particular context of the ESBWR, which, as you defined
2 it --

3 MR. DUBE: You should think LERF would be
4 a subset, yes.

5 CHAIR STETKAR: As any of the greater than
6 tech specs. It's different from I think the example
7 --

8 MR. DUBE: Right. You would take it --

9 MEMBER BLEY: It took us several hours to
10 try to figure out what was going on.

11 MR. DUBE: Yes.

12 CHAIR STETKAR: Yes, it is convoluted at
13 best, but I think we identified the fact that there
14 could be real subtle anomalies in some cases. But in
15 this particular example, I can't see how that would
16 apply.

17 MEMBER CORRADINI: Yes. It should. But
18 can I just --

19 CHAIR STETKAR: Other things, though,
20 where people have defined it perhaps at 25 rem at some
21 other context, what is large, then there might not
22 necessarily be a --

23 MEMBER CORRADINI: Correct. But it is a
24 function of what John is saying. The definition of it
25 if they're inconsistent, one could be encapsulated in

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1 the other, but if you think of it from a logical
2 standpoint and you want to define it such that LRF
3 would encompass.

4 CHAIR STETKAR: In principle, that would
5 make sense. That's right.

6 MEMBER SCHULTZ: So, Don, clearly these
7 are distinctive and very important issues. These have
8 not yet been defined by the staff.

9 MR. DUBE: Right.

10 MEMBER SCHULTZ: But of the issues: the
11 large release frequency as well as the conditional
12 containment failure probability.

13 MR. DUBE: Right.

14 MEMBER SCHULTZ: At least not defined
15 consistently because the next bullet says everyone
16 seems to have a different definition.

17 MR. DUBE: Everyone does.

18 MEMBER SCHULTZ: Thank you.

19 CHAIR STETKAR: That makes it interesting.

20 MEMBER CORRADINI: I am trying to
21 understand, though, that if I were out there, let's
22 just say for the moment that there is some logical
23 consistency. Get across that one. I'm sure you guys
24 will figure that out. To satisfy it because of the
25 way it's defined, you could essentially improve upon

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1 prevention and not have to prove that you have a
2 containment system and associated gear that would
3 essentially because -- I mean, one way to say that is
4 that the -- I'm just looking at your first line -- is
5 that I just reduced the core damage frequency enough
6 that I still at least get a ten percent chance of, no
7 more than ten percent chance of, failure of the
8 containment system.

9 MEMBER SHACK: Conditional containment.

10 MEMBER CORRADINI: It's conditional,
11 conditional. I understand.

12 MEMBER SHACK: Yes. So it doesn't matter
13 how much you --

14 CHAIR STETKAR: It doesn't make any
15 difference what the absolute core damage frequency is.

16 MR. DUBE: There's qualifiers on this, by
17 the way, because the way he --

18 MEMBER CORRADINI: I am trying to
19 understand all the games I can play with this.

20 MR. DUBE: Yes.

21 MEMBER CORRADINI: That's what I'm trying
22 to get at.

23 MR. DUBE: Because the way many have
24 defined conditional containment probability, they have
25 taken large release frequency into the numerator and

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1 divided it by core damage frequency in the denominator
2 or is that -- but yes. Large release frequency in the
3 numerator --

4 CHAIR STETKAR: Yes.

5 MR. DUBE: -- and core damage frequency in
6 the denominator and showed that that is less than .1.
7 You could be in a situation where you reduce core
8 damage frequency, which is a good thing. You are
9 right. You reduce the denominator. And CCFP goes up.

10 CHAIR STETKAR: Well, it depends on the
11 sequences that are going into containment failure.

12 MR. DUBE: Yes, yes. And so if you have
13 less than .1 and doing a good thing, which is reduce
14 core damage frequency, make CCFP go to .1. Is that a
15 reason not to approve a change? The answer is no.

16 CHAIR STETKAR: Don, for those, just out
17 of curiosity -- and we've got to be a little bit
18 careful about time.

19 MR. DUBE: Yes.

20 CHAIR STETKAR: The example you just
21 mentioned was suppose I define large release frequency
22 in whatever way I want to define it, some way of
23 defining it. That is less than all of the sequences
24 that result in any release. So, for example, I define
25 large release frequency as some subset of sequences

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1 that result in an off-site release because of some
2 criteria I set on size or something. But there are
3 sequences that have failure to isolate small lines
4 that I have not included in what I have defined as
5 large.

6 Is the notion of conditional containment
7 failure probability only restricted to apply to
8 something that's defined as large or is it this --
9 okay.

10 So your example, if I have cleverly
11 defined what I call large, will underestimate
12 conditional containment failure probability if that
13 actually means anything that results in a release from
14 the containment, small releases, whatever small is?

15 MR. DUBE: I can't think of any situation
16 where CCFP is not conservative.

17 CHAIR STETKAR: Okay. But just in
18 practice and what has been done so far?

19 MEMBER CORRADINI: By the time I -- it
20 strikes me -- again, you guys will figure this out,
21 but it strikes me that the staff ought to come up with
22 a consistent definition

23 CHAIR STETKAR: I think if Don gets
24 further, you'll see how they are --

25 MEMBER CORRADINI: And the definition of

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1 LRF ought to be consistent with the definition of
2 containment failure. You're not going to have these
3 inconsistent if --

4 MR. ADER: Mike, if I can interject, it's
5 probably time to go back. The history of LRF was LRF
6 was really LERF. It was never called LERF. It came
7 out of safety goal as a surrogate for the safety goal.

8 So all the effort we spent to try to
9 define LRF, it was in terms of an early fatality. And
10 at 10-6, it becomes a de facto new safety goal. So
11 the recommendation was to terminate the effort to do
12 that.

13 There were others. There was containment
14 failure probability and 24-hour intact containments
15 that were judged as reasonable containment performance
16 goals.

17 So people get confused that LRF was
18 intended to be a latent containment failure metric.
19 It was always intended to be LERF.

20 MEMBER CORRADINI: That's fine, but the
21 last time I paid attention to this and tried to
22 understand it was in 1992. All right? And the
23 Commission SRM or something -- I thought it was the
24 Commission SRM that wrote this -- was that it was more
25 the latter: ample time for some sort of external

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1 action, such as evacuation, emergency preparedness,
2 and on the order of a day or two before the
3 containment starts releasing large amounts of
4 radioactive material.

5 And that's how at least it was started.
6 And then all of these definitions, at least in my
7 memory, started being promulgated.

8 MR. ADER: The day or 2 was the 24-hour --

9 MEMBER CORRADINI: Correct.

10 MR. ADER: -- service level C.

11 MEMBER CORRADINI: Correct.

12 MR. ADER: The LERF was a surrogate for
13 the early fatality metric in the safety goal. So if
14 you go back and look at all of the papers that went
15 back and forth, staff proposed it would be a release
16 in curies that would result in an early fatality. It
17 would be a containment failure that would result in
18 early fatality. We tried to come up with a surrogate
19 and equivalent curies of iodine. And where we ended
20 up is at 10-6, it was a de facto new safety goal.

21 And the other constraint we had from the
22 Commission is don't come up with a definition that
23 became a de facto new safety rule.

24 So in the end, staff recommended
25 terminating the effort because it didn't seem to be

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1 needed at that time because we had the other
2 containment performance metrics that achieved the
3 purpose of having something for new reactors to
4 review, acceptability of containment performance.

5 The unfortunate part is this kind of
6 lingered out there. At 10-6 LRF, it's given staff a
7 way to judge have the new designs provided enhanced
8 safety, enhanced margins, enhanced severe accident
9 protection so we can judge that. It's not been a hard
10 criterion, but the issue now if we went back and said
11 we should come up with a new definition, we're going
12 back 20 --

13 MEMBER CORRADINI: And you're saying
14 there's no reason to replot that ground?

15 MR. ADER: There are other activities I
16 think going on in the discussions of some of the
17 Fukushima recommendations that talk about is there a
18 need for another metric that would deal with
19 long-term. And those are on a different track.

20 MEMBER CORRADINI: Okay.

21 MR. ADER: So I would --

22 MEMBER CORRADINI: Okay. That's fine.

23 MR. ADER: I would clearly wait for those.

24 MEMBER CORRADINI: But can I just restate?

25 Can I just restate kind of in the middle of what you

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1 were talking about to make sure I've got it in my
2 head?

3 At least in the spirit of it, staff was
4 looking at essentially that with the new designs and
5 with the containment systems within those designs, the
6 chance of early fatality would be less than this
7 metric, 10⁻⁶?

8 MR. ADER: We judge them are the -- you
9 know, they have given us different definitions of LRF.
10 And we judge that they all are below this metric.

11 MEMBER CORRADINI: Okay. Thank you.

12 MR. ADER: And on a later slide, you will
13 see the proposal deals with the defense-in-depth issue
14 on containment of how we are proposing to address
15 that.

16 MEMBER CORRADINI: Okay.

17 MR. ADER: So I prefer not to go back 20
18 years and go through that whole effort that we
19 concluded we couldn't come up with a definition before
20 tied to the safety goal.

21 MR. FULLER: Yes. This is Ed Fuller from
22 Severe Accident and TRA Branch in the Office of New
23 Reactors.

24 I just wanted to point out a couple of
25 practical aspects of this in terms of how we do our

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1 new reactor reviews. First, turning to how large
2 release frequencies are, in fact, evaluated in
3 practice is that you have to come to grips with the
4 fact that you have a limited number of release
5 categories that the applicant has chosen to
6 characterize the accident scenarios in. And when you
7 look at those, those release categories, you
8 invariably find that all but the one with tech spec
9 leakage would lead to releases that one could probably
10 pretty definitely say are large in the sense that they
11 would be greater than 25 rem at the site boundary you
12 have taken out. And that makes kind of a calculation.

13 So you pretty much direct it down to the
14 conservative end of things when you look at what the
15 condition of containment failure probability is. So
16 it, in effect, is the total. The denominator is the
17 total core damage frequency. The numerator is
18 everything except tech spec leakage is what it comes
19 down to.

20 And the other aspect, practical aspect, is
21 that since we are looking at a variety of initiators,
22 not just internal events of power but internal floods,
23 internal fires, and in principle other external
24 events, what you find is that you really can't -- and
25 low-power shutdown events. What you find is you

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1 really can't put low-power and shutdown events or
2 external events into the equation because the external
3 events are very, very site-specific. And, of course,
4 the conditional containment failure probability for
5 low-power and shutdown events is usually very high, if
6 not close to unity. So you have to just throw those
7 out.

8 So as a practical matter, you are left
9 with a fairly easy way to evaluate both metrics. And,
10 of course, LRF is not the same as large early release
11 frequency because you're not concerned with when the
12 release happens or if evacuation takes place or not.

13 All I'm trying to say is that in practice,
14 it's not really an impediment.

15 CHAIR STETKAR: Okay. I don't want to
16 hold up the discussion too much, but we do need to be
17 cognizant of time. And I think we have to break at
18 12:00 because we have another --

19 MR. DUBE: Okay.

20 CHAIR STETKAR: -- meeting to attend to.
21 And I'd like to see if we can get through the
22 ex-vessel severe accident --

23 MR. DUBE: Okay. We will.

24 CHAIR STETKAR: -- stuff by 12:00. So if
25 you can --

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1 MR. DUBE: I'll speed it up.

2 CHAIR STETKAR: -- keep that in mind and
3 that the members --

4 MR. DUBE: We came down to three --

5 CHAIR STETKAR: We're going to run, you
6 know, the full afternoon anyway, but there's a lot to
7 discuss on the ROP, --

8 MR. DUBE: Right.

9 CHAIR STETKAR: -- tabletop, and the
10 Commission paper.

11 MR. DUBE: We came down to three possible
12 options of -- I'll call them group of options. One is
13 to continue using large release frequency and CCFP
14 indefinitely -- well, that doesn't seem to solve it --
15 continue to use LRF and CCFP indefinitely but add in
16 LERF at some point and propose initial fuel load for
17 a number of reasons or transition from LRF to LERF at
18 or prior to initial fuel load and then discontinue the
19 use of LRF and CCFP thereafter.

20 So graphically this would be option 2A.
21 So you have design certification COL application, a
22 diamond at COL issuance. You have a nice diamond at
23 Initial fuel load, which is a milestone that can use
24 CDF and LRF and CCFP for the whole range.

25 In the interest of time, I won't go

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1 through all the advantages and disadvantages, but
2 there are a lot more disadvantages than advantages for
3 option 2A. So we ruled that out.

4 Option 2B is a perturbation, which is
5 continue to use CDF and LRF and CCFP indefinitely and
6 add LERF at initial fuel load or perhaps a little bit
7 prior to it depending on whether an applicant
8 proposed, a license holder proposed risk-informed
9 initiative.

10 That had advantages and disadvantages.
11 Advantages are supports late calculation, continue to
12 use large release frequency and CCFP, which were used
13 in the original licensing using LERF as consistent
14 with reg guide 1.174 in the ROP. The disadvantages
15 are now we have two books, license holder has two
16 books: a large release frequency book and an early
17 release frequency book. It could be viewed as
18 consistent with the SRM because now going forward,
19 operating reactors only use LERF. New reactors are
20 using both LRF and LERF. It seems to be consistent
21 with the Commission direction. And it's an added
22 burden on licensees.

23 MEMBER ARMIJO: When would you have to use
24 LRF again at that point?

25 MR. DUBE: Never.

1 MEMBER ARMIJO: Never? Even in an
2 amendment to a license --

3 MR. DUBE: No.

4 MEMBER ARMIJO: -- application, you would
5 --

6 MR. DUBE: No. That is our option 3, our
7 2C.

8 MEMBER ARMIJO: So you would just finish
9 with an LRF since that one is --

10 MR. DUBE: That's it.

11 MEMBER ARMIJO: They crossed the line.
12 And we would never have to look at that parameter
13 again.

14 MEMBER CORRADINI: That's 2C.

15 MR. DUBE: Right. That's option 2C, right
16 here.

17 MEMBER CORRADINI: The graphics help.

18 MR. DUBE: CDF and LRF and CCFP have been
19 used. They served their purpose, got the plant
20 license. And now somewhere at or prior to initial
21 fuel load, we have closed that chapter. And we say we
22 are going to be consistent with operating reactors and
23 just use CDF and LERF.

24 We choose initial fuel load for a number
25 of reasons. First is a regulation saying that the

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1 license holder has to have a level 1 and level 2 PRA
2 at initial fuel load that meets NRC-endorsed consensus
3 standards one year prior. So initial fuel loads are
4 already on a very magic milestone.

5 I have a dashed line that says, well, one
6 could transition anywhere before based on -- you know,
7 if someone proposed some risk-informed initiative,
8 like risk-informed tech specs, that uses LERF as a
9 metric, one might want to have done this transition
10 somewhat before, depending on when they submitted a
11 license amendment request. So we're not going to say
12 necessarily just only at initial fuel load. There can
13 be some overlap, if you will. And that's option 2C.

14 The advantages, it's consistent with the
15 SRM directions. Well, that's good. It harmonizes
16 metrics for all operating reactors, current and new,
17 going forward.

18 There are some disadvantages because the
19 LRF and CCFP were part of the original design
20 objective in the certification. They would no longer
21 be tracked. You know, there is a -- you probably
22 remember this. Six months ago there was a provision
23 in reg guide 1.174 to look at the impact on late
24 containment failure. And RF could be helpful in that
25 regard, but, as Charlie Ader alluded to, you know,

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1 staff is proposing that we add discussion along
2 containment performance in section 2.2 of reg guide
3 1.174 by referring to the containment performance
4 objectives that are in these two very important
5 Commission papers and associated SRM, SECY-90-016 and
6 93-087. Those are the Commission papers that specify
7 all of the containment performance objectives for new
8 reactor design.

9 So we think we can address the issue of
10 containment performance by making this one change to
11 reg guide 1.174 that mentions this containment
12 performance objective just for the new reactors that
13 have been licensed.

14 And because this is existing
15 Commission-approved policy for new reactors, we don't
16 think we could get permission approval per the SRM to
17 put this in reg guide 1.174. I mean, we'll mention it
18 in the paper. And, of course, the Commission can
19 always come back and say, "Yes" or "No." But we think
20 this is fair game to add to reg guide --

21 MEMBER CORRADINI: The fact that you
22 explained this tells me this is the one you want.

23 MR. DUBE: Yes.

24 MEMBER CORRADINI: Okay.

25 MEMBER ARMIJO: Is there any way for if

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1 you do this where something can happen or a series of
2 things can change that would lead to undermining the
3 licensing basis for the plant based on CDF, LRF, and
4 CCFP, somebody come back and challenge you, say, "All
5 the changes you have made since fuel load have
6 undermined or violate licensing basis of this plant"?
7 Is that a possibility?

8 MR. DUBE: I never say never, but, I mean
9 --

10 MEMBER ARMIJO: Oh, no. I'm not asking
11 you --

12 MR. DUBE: -- I think we felt comfortable
13 again on the reg guide 1.174 exercise we talked about
14 20 minutes ago in all the activities that we did that
15 there's repeatedly -- you know, RISC metrics is a
16 necessary -- you know, load change in RISC is a
17 necessary but not sufficient condition. And we have,
18 you know, defense-in-depth requirements in here reg
19 guide 1.174 long-term containment performance.

20 Specifically containment performance is a
21 defense-in-depth measure that I think we feel
22 comfortable that there is a reasonable assurance that
23 enhanced level of safety wouldn't be degraded by this
24 transition.

25 MEMBER ARMIJO: I like the idea of closing

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1 the books and archiving it at that point as long as
2 somebody can't come back and challenge a licensing
3 basis.

4 MEMBER CORRADINI: Sam's point I think is
5 fair. You're going to -- even though you think you --
6 excuse my English -- finessed it, you've only finessed
7 it to the extent that you have defined it in a way
8 that is consistent so that somebody can understand how
9 you went from method of measurement 1 to method of
10 measurement 2.

11 MEMBER ARMIJO: Right. And I think that's
12 what I -- yes. That's exactly -- and the staff is
13 comfortable that that is unlikely?

14 MR. DUBE: Right, and especially because
15 of the provision, long-term containment performance,
16 to continue to meet the containment --

17 MEMBER ARMIJO: By adding that at --

18 CHAIR STETKAR: Don, do those SECY papers
19 have a numerical performance criterion like the ten
20 percent CCFP?

21 MR. DUBE: Yes, that is where the ten
22 percent comes from. That is where the ten percent
23 comes from.

24 CHAIR STETKAR: Thank you. Thanks.

25 MR. DUBE: Well, but when we were looking

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1 at containment performance objectives, we were looking
2 more at this. We have a footnote in the Commission
3 paper. I'll call it more the deterministic
4 containment performance objective, which is the
5 containment should maintain its role as a reliable,
6 leak-tight barrier by ensuring that containment
7 stresses do not exceed ASME level C for containment
8 performance, so on, so forth, for concrete for
9 approximately 24 hours following the onset of core
10 damage under the more likely severe accident
11 challenges. And following this period, the
12 containment should continue to provide a barrier
13 against the uncontrolled release of fission products.

14 You might recall six or eight months ago
15 staff created a new reg guide to address this new
16 reactor designs. And remember we came up saying that
17 one way of defining more likely severe accident
18 challenges is roll-up the core damage sequences that
19 amount to, for example, 90 percent of the sequences,
20 which is consistent with the .1 conditional
21 containment failure probability.

22 So we are not proposing that one
23 necessarily explicitly going forward every time a
24 change is made come back against that CCFP. We're not
25 proposing that we continue with that. But the license

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1 holder could continue to demonstrate that they meet
2 this containment performance objective.

3 CHAIR STETKAR: I guess I am a bit
4 confused because I read the discussion of this in the
5 paper. And I guess I didn't understand what you just
6 said, that although you are making reference to the
7 SECY papers that do address some sort of quantitative
8 conditional containment failure probability, whatever
9 that means, you note that the level 2 PRA standard
10 when it's released and however it is reviewed and
11 endorsed by the staff will define releases according
12 to release categories.

13 MR. DUBE: Right.

14 CHAIR STETKAR: And in principle, one
15 could then provide guidance about the characteristics
16 of the release categories that you roll up into large
17 early release frequency or each containment failure of
18 any form.

19 MR. DUBE: Each licensee will have to --
20 if they're going to use it, large early release
21 frequency will have to roll up the level 2 PRA
22 endpoints, which are release categories --

23 CHAIR STETKAR: Into something that they
24 call large early release frequency.

25 MR. DUBE: Right.

1 CHAIR STETKAR: They could do a similar
2 roll-up into something that is any containment failure
3 for the containment, conditional containment, failure
4 probability.

5 MR. DUBE: They could do that.

6 CHAIR STETKAR: But you're not proposing
7 that they do that.

8 MR. DUBE: No.

9 CHAIR STETKAR: So, in principle, they
10 could make changes that make the conditional
11 containment failure probability for small releases
12 1.0. And they would never trip over a threshold.

13 MR. DUBE: I mean, I can't think of any
14 realistic situation.

15 MEMBER SCHULTZ: But they would leave this
16 -- this is a design criteria. And they would leave
17 that behind upon operation.

18 MR. DUBE: Right. It was an original
19 objective for licensing.

20 MEMBER SCHULTZ: Right.

21 MR. DUBE: But they still need to track
22 large early release frequency.

23 MEMBER SCHULTZ: Correct.

24 MR. DUBE: And the goals for large early
25 release frequency are an order of magnitude lower than

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1 core damage frequency.

2 CHAIR STETKAR: But that will be -- the
3 thing that is called large on a basis will be defined
4 conditions. What I'm concerned about is this notion
5 of what does conditional containment failure
6 probability mean in the context of all of this?

7 MEMBER SCHULTZ: Design and operation?

8 CHAIR STETKAR: Design and operation.
9 That's right. You know, can we get into a situation
10 where I still meet the criteria for what I call large
11 early release frequency --

12 MEMBER SCHULTZ: Right.

13 CHAIR STETKAR: -- which is a box that I
14 have thrown things into --

15 MEMBER SCHULTZ: Right.

16 CHAIR STETKAR: -- and, yet, have a large
17 fraction -- that's a pejorative term but a fairly
18 highly measurable fraction of core damage frequency
19 that doesn't give a large release, really, but has
20 failure to isolate small containment penetrations;
21 small late releases, if you will?

22 MR. DUBE: Yes. I mean, you know, the --

23 CHAIR STETKAR: From what I asked you
24 earlier, you said, well, conditional containment
25 failure probability isn't restricted to just large

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1 early release or large release divided by total. It's
2 any failure of the containment.

3 MR. DUBE: Right.

4 MEMBER CORRADINI: But the way this is
5 defined is historically consistent and, similar to
6 what Ed just said up here, which is they just take the
7 radio of the LERF to the CCFP.

8 CHAIR STETKAR: That's correct.

9 MEMBER CORRADINI: But this wouldn't be
10 maintained after that fact anyway. This is in a
11 performance objective independent of all of these
12 numbers.

13 CHAIR STETKAR: It depends on what you
14 define as reliable leak-tight barrier. If reliable
15 leak-tight barrier is only a barrier against large
16 early releases, I understand that. If it's a barrier
17 against any release --

18 MEMBER CORRADINI: That's not the case.
19 That's not the case. I mean, the context, at least
20 the context I -- I mean, Charlie has got the best
21 history on this, but the context on an earlier thing
22 was it's all relative to what would need to be done
23 prior to a new set of plant designs and what were the
24 expectations of -- what was the performance of the old
25 plants coming out of the NUREG-1150? And it was

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1 essentially that you had time to essentially effect
2 some sort of action in those first couple of days. Do
3 I have it approximately right?

4 MR. ADER: In terms of coming up with
5 these objectives?

6 MEMBER CORRADINI: Yes.

7 MR. ADER: Yes. I mean, this was part of
8 -- as I remember it, there were a number of lessons
9 learned post-TMI, the severe accident policy
10 statement, here are some challenges, you know, core
11 spreading, containment performance long term. And
12 these were put in. This one was put in to maintain
13 that containment barrier for the 24 hours. This is a
14 way to test the containment.

15 CHAIR STETKAR: I mean, I understand this.
16 My only concern is, is there a gap in terms of intent
17 of providing confidence in any releases from the
18 containment as you transition from --

19 MR. DUBE: Right, but recall, too, in reg
20 guide 1.174, they have to describe --

21 MR. ADER: It's whatever.

22 MR. DUBE: Yes. In reg guide 1.174,
23 there's a section 2.2, "Need to discuss the impact of
24 the change license amendment request, containment
25 performance."

1 MEMBER CORRADINI: So that would give you
2 the opportunity to --

3 MR. DUBE: That's an opportunity for the
4 staff to issue a --

5 CHAIR STETKAR: Yes, yes.

6 MR. DUBE: -- request for additional
7 information, saying, "Exactly what does that mean?
8 What calculations, what results have you done to
9 demonstrate that is the case? And did you impact this
10 aspect of containment?"

11 MR. ADER: Don, you can correct me if I'm
12 wrong, but what we're trying to do here, the
13 Commission guidance was they reaffirmed the existing
14 metrics, which would say, "Go away from 10-6 LRF."

15 1.174 has the part of it is you address an
16 impact of the change on long-term containment
17 performance. And from what I understand -- I haven't
18 been involved in it as many of them -- that that is
19 kind of ambiguous.

20 MR. DUBE: Right.

21 MR. ADER: What does that mean in
22 practice? For new reactors that have done these
23 calculations so they have a basis to refer back to so
24 we're trying to, at least for the new designs, provide
25 a little additional guidance of what they could use to

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1 address that long-term containment performance because
2 they can go back to what they have calculated when
3 they came in regionally?

4 So our attempt here is to try to narrow
5 this ambiguity in one part of the 1.174 by adding this
6 or proposing to add this given constraints we have
7 with 10-6. So it may not be perfect, but --

8 MEMBER CORRADINI: Yes. It's not perfect
9 --

10 CHAIR STETKAR: And I guess I have to be
11 careful in our time here, but is there a down side or
12 did you think about LERF and CCFP? I've forgotten.
13 That's not one of your mix of three.

14 MR. DUBE: No, that's not.

15 CHAIR STETKAR: That's a different --

16 MR. DUBE: Hybrid, yes.

17 CHAIR STETKAR: Did you think about that?
18 Is there a down side to doing that?

19 MR. DUBE: Yes. I mean, the down side is
20 --

21 CHAIR STETKAR: You have to define what
22 CCFP means.

23 MR. DUBE: Yes, universal definition.

24 CHAIR STETKAR: Yes, but in principle, if
25 you accept the notion that the level 2 PRA standard

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1 will define end states and you can not kind of
2 ambiguously put end states in a box, I can define to
3 you what I feel is containment failure. You can look
4 at that and say, "Well, why didn't you add this end
5 state?" --

6 MR. DUBE: Right.

7 CHAIR STETKAR: -- or whatever.

8 MR. DUBE: All right. So CCFP is
9 calculated, but it's not used in any risk-informed
10 application, including reg guide 1.174 and the
11 acceptance guidelines or reactor oversight process.
12 So it's a truly academic exercise.

13 MR. ADER: Hey, Don --

14 CHAIR STETKAR: Well, but it's a
15 quantitative measure of defense-in-depth.

16 MR. DUBE: Yes. And this is, too, I
17 guess.

18 MR. ADER: Don?

19 CHAIR STETKAR: Charlie?

20 MR. ADER: We had had these discussions
21 before. And I think Don had convinced me we're
22 talking plants that have been built. Someone wants to
23 come in and do a design change. So they have the good
24 design change. Say they're meeting the .1 CCFP. They
25 want to do a design change that lowers core damage

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1 frequency that somehow they would not be able to meet
2 the CCFP anymore.

3 We had some examples, which I can't think
4 of at this time. Don may --

5 CHAIR STETKAR: Yes. In principle, you
6 could think of ways that do that.

7 MR. ADER: I want to say I can lower CCDF,
8 but I will trip this threshold. So I don't want to
9 make that improvement.

10 CHAIR STETKAR: Yes.

11 MR. ADER: So at least he convinced me
12 maybe that was not the best hard-line --

13 MR. DUBE: Okay. And the Commission
14 policy statement said CCFP. I mean, that's an
15 objective, but it should not be used to discourage
16 accident prevention, you know. Accident mitigation
17 should not take precedence over accident prevention.
18 And if you're not careful, one could play that game.
19 You're right at the border of .1.

20 We found that, you know, the fact that the
21 reg guide says you have to look at the impact of
22 containment performance and the fact that we are
23 proposing to insert this kind of a containment
24 performance objective, which is current policy, into
25 the reg guide 1.174 we think meets the intent without

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1 having all the burden of trying to track LRF and CCFP
2 indefinitely into the future and have new reactors
3 diverge from current reactors.

4 Yes. There's no perfect solution. That's
5 why I first want to try to tackle this in 20 years.
6 So, I mean, these are the advantages and
7 disadvantages. I don't know what more to say. I
8 think that's all I --

9 CHAIR STETKAR: Anybody else? Any
10 members? Because we --

11 MEMBER BLEY: One little thing. If you
12 wanted clarification on that, a several year ago
13 discussion with Doug True can provide it in two
14 sentences.

15 CHAIR STETKAR: That would be very useful,
16 I suspect, for those of us who don't remember, which
17 is me, and those of us who were here, which is a
18 fraction of the people in the room.

19 MEMBER BLEY: Maybe it's four sentences.
20 Doug organized his talk to prove his claim that
21 everybody has got it wrong and that LRF is a subset of
22 LERF. When we just talk conceptually, that's not
23 right, but where it came from was some calculations
24 Doug provided for us.

25 And, although these definitions weren't

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1 quite around when -1150 was done, he went back to the
2 -1150 results, found the scenarios that would be
3 tagged as LERF now, calculated frequency, and then he
4 provided a staff calculation that had calculated LRF
5 from the results and showed that the frequency of LERF
6 was much less than LRF.

7 The trick here, the problem, is that that
8 calculation by staff of LRF from -1150 got its
9 syllogism backwards. It calculated LRF as the
10 frequency of one or more people dying. So it's an
11 overestimate of LRF.

12 Not every LRF leads to somebody being
13 killed, but you are right in saying if a person is
14 killed, it is an LRF. So it is a reasonable
15 calculation for what they were trying to show, but
16 when you overlay those two, you get silly results.
17 And that's because not having really killed somebody.

18 So it's a calculation that wasn't really
19 the frequency of large release. It was the frequency
20 of one or more being killed, just got language all
21 screwed up.

22 MR. DUBE: Yes.

23 MEMBER BLEY: It took a long time to
24 figure out what was going on that day.

25 MR. DUBE: Yes. The question is, do we

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1 want to propagate this into the future?

2 MEMBER BLEY: Heavens, no.

3 (Laughter.)

4 CHAIR STETKAR: No, no.

5 MEMBER SCHULTZ: Don, for clarity of

6 clarification --

7 MR. DUBE: Yes? Sure.

8 MEMBER SCHULTZ: -- I would recommend that
9 on the slide that you have for option 2C, beyond the
10 time when you leave behind the CCFP that you add to
11 the going-forward requirements that you are going to
12 augment. You are going to augment the discussion on
13 long-term containment performance.

14 MR. DUBE: Good point, yes.

15 MEMBER SCHULTZ: Because it looks like you
16 are leaving everything behind on containment, and
17 you're not.

18 MEMBER CORRADINI: You are trying to say
19 that the paragraph we just discussed really is the --

20 CHAIR STETKAR: And the paper builds that.

21 MR. DUBE: Yes. The paper does.

22 MEMBER SCHULTZ: The slide looks
23 different. That is to make sure that it's shown that
24 there is a requirement related to containment that's
25 going to continue.

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1 MR. DUBE: Okay. Good point. This slide
2 may only be used one time. And that would be at the
3 full ACRS.

4 MEMBER CORRADINI: We'll make sure that
5 you remember that.

6 CHAIR STETKAR: We've got a good fraction
7 of the Committee here. Some important people are not
8 here.

9 MR. DUBE: Remind me because I have
10 short-term memory loss.

11 CHAIR STETKAR: Some important people are
12 not here.

13 MR. DUBE: Thank you. Okay.

14 So tier 2 changes. I am going to get us
15 within the half-hour. Okay. This was a specific
16 request or direction from the Commission to look at.
17 We knew there was a working group at NRC called Change
18 During Construction. And the changes for ex-vessel
19 severe accident features is a subset of that larger
20 change during construction. So we knew we were going
21 to have to address this issue, even before the
22 Commission SRM. So this is why I said we had this
23 public workshop in December 2010, before the SRM,
24 because we knew we were going to have to address it
25 regardless.

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1 6. NEI 96-07 APPENDIX C

2 MR. DUBE: NEI 96-07 is a nice one-stop
3 shopping document for all of the change processes for
4 the part 52 plants. It discusses tier 1 changes, tier
5 2, tier 2* -- I'm assuming I don't have to get into
6 all of that -- impact of design basis accidents, even
7 aircraft impact assessment, loss of large areas.

8 So what enters into this appendix C to NEI
9 96-07, which is the guidance 50.59 and then it may
10 direct the licensee to different directions, but in
11 different guidance reports, but it is a one-stop
12 shopping. And there is guidance on the tier 2 changes
13 to ex-vessel severe accidents. And these are codified
14 in the rulemaking for each of the certified designs.

15 So we had a second workshop on August 9th.
16 And we had a series of public meetings looking at
17 appendix C in general. And there have been three
18 since the past summer.

19 So, to refresh your memory, this is an
20 advanced boiling water reactor from -- this is
21 appendix A to part 52. So this is, in effect, a rule
22 or regulation.

23 And VIII.B.5.c says, "A proposed departure
24 from tier 2 affecting resolution of an ex-vessel
25 severe accident design feature identified in the

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1 plant-specific DCD requires a license amendment if"
2 one of two conditions is met. "There is a substantial
3 increase in the probability of an ex-vessel severe
4 accident such that a particular ex-vessel accident
5 previously reviewed" that was "not credible" becomes
6 "credible or there is a substantial increase in the
7 consequences."

8 Now, one of our assignments was to tackle
9 what a substantial increase is because that went
10 unanswered for 15 years. So I feel good about this.

11 I don't plan to talk about it because I
12 think we talked about it a little bit before. But we
13 believe what's in the guidance is good.

14 CHAIR STETKAR: Do you know what the word
15 "credible" mean?

16 MEMBER CORRADINI: I understand number 2.
17 I have read through number 1 a couple of times. What
18 does that even mean?

19 MR. DUBE: Sometimes in a design control
20 document, you may not find the word "credible." You
21 may find words like "not physically possible," "has
22 been ruled out," "not possible," "beyond belief" or
23 some terms like this.

24 CHAIR STETKAR: "Not possible" and
25 "impossible" are pretty well-defined words.

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1 MR. DUBE: Yes. But basically "not
2 credible" means -- and we'll talk about this. There
3 are a number of severe accident challenges by
4 regulation that the COL holder as design certification
5 has to address. And they specifically have created a
6 design feature to address those. And because of those
7 design features, a severe accident challenge is not
8 likely to occur. I mean, I don't know what more to
9 say.

10 Sometimes you will see the design
11 certification document actually an actual probability,
12 like we believe that high-pressure melt ejection is
13 10-8 or less. And because of that, we are not going
14 to further analyze these scenarios. Sometimes you'll
15 see the word "credible."

16 I don't know if I answered your question,
17 but a design feature has been implemented to address
18 a severe accident challenge. And because of that,
19 there is no further analysis done.

20 MEMBER CORRADINI: That's what number one
21 is. And some parts will be taken that will then
22 reverse that.

23 MR. DUBE: Exactly. So --

24 MEMBER BLEY: To make it more likely.

25 MR. DUBE: Right. Let me give you an

1 example.

2 MEMBER BLEY: Right.

3 MR. DUBE: I have a pressurized water
4 reactor. I am worried about high-pressure melt
5 ejection and direct containment heating. So I
6 installed depressurization valves using squib valves
7 so that in a severe accident, operator opens these
8 depressurization valves that crashes the reactor
9 coolant system pressure down to very low value. And
10 so even if the molten debris melts to the bottom of
11 the reactor vessel, we're not going to have the
12 high-pressure melt election. And so that --

13 MEMBER CORRADINI: And somehow the valve
14 design has changed, and that changes the probability
15 of that event?

16 MR. DUBE: Exactly. Exactly. So in so
17 many words, as a design feature that addresses
18 high-pressure melt ejection and now I'm looking at a
19 change which is I had this feature. I do something to
20 that, turn something that has been not credible,
21 high-pressure melt ejection, do something that makes
22 this, for whatever reason, credible.

23 MEMBER CORRADINI: Thank you. Thank you.
24 That helps.

25 MR. DUBE: And we struggled with this. We

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1 didn't want to come up with a quantitative definition.
2 Basically an example of number one would be a severe
3 -- I have two parallel valves, let's say, paths, put
4 as depressurization. And I do something to the design
5 that severely degrades that capability.

6 MEMBER CORRADINI: Yes. Okay.

7 MR. DUBE: And it's like beautiful art.
8 I know it when I see it, but, I mean, I'm not going to
9 put quantitative numbers on it. And then two is
10 substantial increase in the consequences. It's the
11 same thing. No one has defined substantial increase,
12 but we think we have zeroed in on a definition.

13 So that --

14 MEMBER BLEY: Can I back you up to the one
15 you just had?

16 MR. DUBE: Okay.

17 MEMBER BLEY: Trouble. We all have
18 trouble with this idea of credible, but it's something
19 that you think is very, very unlikely or the designers
20 thought. You could get quantitative if you talked
21 about some kind of fractional degradation or something
22 like that.

23 This still stays -- I mean, this has
24 always been fuzzy, wherever we have had things like
25 this. You know, Impossible is not bad. It's just

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1 hard to prove and then anything that challenges that.

2 But it just seems to me that, at least on
3 some relative basis, you could be quantitative and not
4 leave quite as fuzzy a --

5 MR. DUBE: Good point. We struggled with
6 this. So what's a substantial increase? Is it a
7 twofold increase? Ten percent? One percent?
8 Probably not. Two percent increase? Probably not.
9 Ten percent? Probably not.

10 The other extreme, a tenfold or 100-fold
11 increase in probability? Probably. Where do I draw
12 that magic line?

13 MEMBER CORRADINI: You are saying
14 substantial falls between two to ten. That's what you
15 just told me.

16 CHAIR STETKAR: Two to 100. But, I mean,
17 that is something that could be quantified as an input
18 to the decision process. Even in your example there,
19 the frequency of high-pressure melts is not zero.
20 It's something that can --

21 MR. DUBE: Right.

22 CHAIR STETKAR: -- and is quantified in
23 the PRA. There's some chance that the square valves
24 won't open or --

25 MR. DUBE: Right. Exactly.

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1 CHAIR STETKAR: -- you know, whatever.

2 And any change is measurable as a delta.

3 MR. DUBE: Right.

4 CHAIR STETKAR: I mean, you know --

5 MR. DUBE: But there were --

6 CHAIR STETKAR: It is a credible event in
7 the sense that it can be quantified.

8 MR. DUBE: There were a lot more
9 disadvantages putting a quantitative number to this
10 than --

11 MEMBER CORRADINI: Can I give you another
12 example that troubles me more since you picked that
13 one? So I changed the insulation on the vessel for
14 AP1000.

15 MR. DUBE: Right.

16 MEMBER CORRADINI: And in-vessel retention
17 is threatened.

18 MR. DUBE: That is a substantial increase.

19 MEMBER CORRADINI: But it is my impression
20 -- I used this example specifically because it is my
21 impression in-vessel retention is not part of the
22 license. It was an additional feature that fell
23 outside of it and was only in the PRA.

24 MR. DUBE: The defense-in-depth.

25 MEMBER CORRADINI: So that would not fall

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1 into this category.

2 MR. DUBE: Well, we worked it. We had
3 this example. And we said that would be some feature
4 like that that in-vessel retention and external
5 reactor vessel cooling is a defense-in-depth measure
6 that if one were to make a change that one lost
7 confidence that one would be able to do that, it would
8 be a substantial increase in probability of --

9 MEMBER CORRADINI: So I'll give you
10 another one.

11 MR. DUBE: We end up using this as an
12 example in the guidance. I don't remember now. But
13 we specifically talked about that example.

14 MEMBER CORRADINI: Because where I am
15 going with this is if these measures were the
16 uncertainty of the physics leads you to put it in as
17 a defense-in-depth measure, but I wouldn't apply this
18 rigor to it because the uncertainty of what is
19 occurring is too mushy. Excuse my English. I think
20 of this one. I think of the BiMAC. I can come up
21 with a few of these.

22 But they look better. Do I want to apply
23 this sort of rigor to it? That would get me nervous.

24 MR. DUBE: Well, that's why the writers of
25 the rule specifically chose the word "substantial" for

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1 that reason, because of --

2 MR. ADER: Yes. This was --

3 MR. DUBE: -- severe accident uncertainty.

4 MR. ADER: I mean, as I read the statement
5 of considerations, this was originally going to be
6 under the normal change process. And, for the reasons
7 you said, severe accidents too uncertain that they put
8 it in a change process that has more --

9 MEMBER CORRADINI: Okay.

10 MR. ADER: -- substantial increase, as
11 opposed to significant. Don't ask me --

12 MEMBER CORRADINI: This is why you said 2
13 to 100. Let's just like leave it there.

14 MR. ADER: I think most of these features
15 are in tier 2.

16 MR. DUBE: Some of them are in tier 1. So
17 they would get --

18 MR. ADER: Yes, some are in tier 1.

19 MR. DUBE: It turns out as we did a
20 review, a lot of these area actually mentioned in tier
21 1. So they need a license amendment. This is what
22 can the COL holder do on their own without prior staff
23 approval?

24 MR. ADER: So it is more than just being
25 reflected in the PRA. It is reflected in the design

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1 documents.

2 MR. DUBE: Yes.

3 MEMBER CORRADINI: Okay. Thank you.

4 Thank you.

5 CHAIR STETKAR: Ed?

6 MR. FULLER: Yes. Ed Fuller again.

7 I would like to point out to the group and
8 Mike, in particular, that those SECYs 90-016 and
9 93-087 are used to define what the severe accident
10 challenges are and to define what, in turn, to direct
11 people who design these reactors to include mitigation
12 systems to address these challenges and that 10 CFR
13 52.47(a)(23), I guess, basically addresses very
14 specifically the challenges.

15 One of these is the ability to cool
16 debris. And if you'll look at the AP1000 with its
17 insulation system, that is a system, a mitigation
18 system, that is designed to make sure that you don't
19 have core-debris-concrete interaction that leads to
20 basemat melt-through.

21 So I would say in the context of what we
22 are doing here that, indeed, this is an ex-vessel
23 severe accident mitigation feature and that if it's
24 taken out of its degree of effectiveness, that you
25 could get significant increases in consequences of

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1 such an accident.

2 MEMBER CORRADINI: But since you -- he'll
3 stop me, but let's just push on this one. So when the
4 staff was going through the AP1000, there were some
5 contractors that were asked to look at the license
6 analysis and found that the chance of this not working
7 was more than ten percent. We'll say one out of ten
8 just for the sake of argument. So the chance is
9 essentially the in-vessel retention design in a tier
10 2 is one out of ten.

11 Now, they changed something. What I'm
12 trying to get at is that the change takes me from one
13 out of ten to two out of ten. Do I get nervous or I
14 only get nervous when it becomes nine out of ten?

15 And the reason I am asking the question is
16 the uncertainty in the one out of ten is large.

17 MR. FULLER: Right.

18 MEMBER CORRADINI: It's not one out of
19 ten. It's not ten percent plus or minus one percent.
20 It's more like ten percent plus or minus, plus a
21 factor of four.

22 MR. FULLER: Right. Okay. In this
23 particular case, there's a backup. That is, if the
24 system doesn't work and the vessel fails, you still
25 have a flooded cavity, which is large enough to meet,

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1 for example, the utility requirements document
2 definition of what might be coolable.

3 And since then a lot of experiments have
4 been done. And the indications today are that you
5 would be coolable. So it's more than just the
6 insulation system. It's the backup, too.

7 MEMBER CORRADINI: I understand that, but
8 I just want to press the point because I am just
9 trying to understand the thinking process here because
10 my other way of saying it is that I am saying it now.
11 I will change to the ESBWR.

12 When we went through this discussion
13 there, what was the final point that made some of us
14 -- I don't know which of the some of us it was, but it
15 wasn't me -- feeling good about it, even if the BiMAC
16 didn't work, I still fell within the fact that within
17 the first 72 hours, I wouldn't have a failure.

18 So I am going back to the previous history
19 of how I would address this. That is, even if the
20 added feature didn't function as expected, I still
21 fell within essentially a bigger principle that is
22 maintained.

23 MR. FULLER: Yes. In that case, again,
24 you have enough floor area and height and provided you
25 can keep water in there, you can cool the debris.

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1 MEMBER CORRADINI: Okay. Fine. I
2 understand. Thank you.

3 MR. DUBE: Well, I mean, without holding
4 me to numbers, going from .1 to .2, the staff might
5 not be as concerned, then. But certainly going from
6 .1 to .9 or almost 1, that would certainly represent
7 a substantial --

8 MEMBER CORRADINI: Fine. I'll stop.
9 Sorry.

10 MR. DUBE: So I know I've got to move on.

11 MEMBER RAY: Did you ever figure out what
12 credible meant?

13 MEMBER CORRADINI: We'll just leave that
14 aside.

15 MR. DUBE: Yes. I mean, we have some
16 guidance in there. And we said it's a feature that's
17 been installed to address one of the containment
18 challenges and has -- and use terms like "made it
19 physically impossible," "extremely unlikely," "below
20 some numerical threshold."

21 MEMBER RAY: Okay. Well, the reason I'm
22 asking -- again, I don't want to screw us up here, Don
23 -- is that the word "credible" appears in many places,
24 as we know, not just in this application here. And I
25 was trying to figure out if those definitions that you

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1 were referring to just now were meant to be more
2 universally applicable.

3 MR. DUBE: I've got to be careful because
4 someone way beyond my pay grade has not been able to
5 define credible for 50 years. So I'm not going to be
6 able to do it in this project.

7 MEMBER RAY: Well, sure. I can show you
8 licenses that say "maximum credible" and then if it's
9 greater than that. So, I mean, obviously it's not
10 impossible to be more severe than maximum credible.

11 MR. DUBE: But, I mean, we do state in the
12 guidance that if a feature has been installed to
13 address a severe accident challenge, there is
14 reasonable expectation that it would work. That means
15 that accident sequence resulting from that challenge
16 is not credible.

17 We also made it clear that because it
18 wasn't a universal definition of credible, the various
19 design control documents have used other terms,
20 everything from, like I said, unlikely to physically
21 impossible and so forth.

22 CHAIR STETKAR: We haven't seen teeny-tiny
23 or itsy-bitsy yet.

24 MEMBER RAY: We all acknowledge that the
25 word "credible" is problematic. And I just wondered

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1 if this were some magical answer to the question of
2 what does it mean? I'm going to say no.

3 CHAIR STETKAR: No. I understand that at
4 least the staff is not trying to tackle that issue.
5 They're just propagating it.

6 MR. DUBE: Yes. Okay.

7 CHAIR STETKAR: I don't know if you can
8 make it all the way through, Don, but see how far you
9 can get. We do have to end at 12:00.

10 MR. DUBE: Okay.

11 CHAIR STETKAR: That is a magic time.

12 MR. DUBE: All right. So there is a
13 definition of what is meant by "ex-vessel severe
14 accident" in the statement of consideration and states
15 explicitly the core has melted to the reactor vessel
16 and containment is being challenged. And I'll just
17 leave it at that.

18 These are the five specific containment
19 challenges that are in 52.47(a)(23) and .79(a)(38).
20 We reached a consensus during the workshops that
21 containment bypass is not necessarily by the
22 definition of statement of consideration an ex-vessel
23 severe accident feature or features to address
24 containment bypass because you can have a containment
25 bypass, like an ISLOCA, where the molten debris is not

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1 necessarily melted through the reactor vessel.

2 So the result of that is we found that
3 certain accident features do not address ex-vessel
4 conditions and the VIII.B.5.c don't apply. And I
5 mentioned ISLOCA/containment bypass. This is a gap in
6 the -- and, worse, it's a gap in the rule, but it is
7 certainly a gap in the guidance.

8 We reviewed NEI 96-07. We made comments,
9 and those have been incorporated. So we're happy with
10 the ex-vessel portion. But the real bottom line is
11 that last bullet: In a worst case, a significant tier
12 2 change to a non-ex-vessel severe accident feature,
13 up to and including permanent removal from service,
14 could be made without prior NRC approval. And this is
15 what staff is concerned.

16 Now, this is theoretical, but the gap --
17 and I'll show you a Venn diagram and a process
18 diagram. I mean, it is possible in the worst case to
19 visit a feature there that is put in to address severe
20 accidents. Because it's not addressing an ex-vessel
21 severe accident, as defined in the regulation here --

22 MEMBER BLEY: When you say, "could be
23 made," could be made without having to raise a flag
24 about it under risk-based?

25 MR. DUBE: Yes. It could be screened out

1 by the current process.

2 So here is a Venn diagram, going back to
3 ninth grade mathematics. These are the five --

4 CHAIR STETKAR: Not my ninth grade.

5 (Laughter.)

6 MR. DUBE: Challenges. If you look at
7 what ex-vessel severe accident is defined per the
8 statement in its consideration, certainly
9 core-concrete is within that definition.
10 High-pressure melt ejection is within that definition.
11 You could have a hydrogen explosion without having an
12 ex-vessel severe accident. So the red line circle
13 crosses through there.

14 It wasn't clear -- and I looked very
15 closely whether one was referring to in-vessel steam
16 explosion or ex-vessel steam explosion --

17 MEMBER CORRADINI: Your red is right. It
18 is a good red line.

19 MR. DUBE: So I divided that. Now, I
20 cannot for the life of me think of a design feature
21 that a designer specifically put in just for the
22 purpose of mitigating or preventing in-vessel steam
23 explosion. I mean, I just can't think of it, and I
24 can't think. But, nevertheless, the line does go
25 through there.

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1 And containment bypass, as I mentioned, is
2 to induce thermal steam generator tube rupture or
3 interfacing systems LOCA is not an ex-vessel severe
4 accident necessarily by the definition. So there is
5 a gap.

6 Okay. Another way to look at it is a
7 process diagram. And I am going to point out where
8 these two issues can occur. So let's start at the
9 change. There is a change that a license holder wants
10 to make.

11 First question, is it tier 1 or tier 2?
12 Remember, tier 1 required prior NRC approval. And
13 tier 2* is something in between tier 1 and tier 2, but
14 it requires prior NRC approval. This is typically
15 anything having to do with the fuel design and other
16 things.

17 CHAIR STETKAR: They typically disappear
18 after the first operating cycles.

19 MR. DUBE: Yes. If the answer is yes, a
20 license amendment request is necessary. If the answer
21 is no, then by definition, what's left is it's tier 2.
22 Then the question is, is it an ex-vessel severe
23 accident feature as defined in the statement of
24 consideration because we have no other definition?

25 If the answer is yes, then you go to NEI

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1 96-07, appendix C, 4.4.2.3. Then the question is, is
2 it something that has been evaluated and deemed
3 credible? If the answer is yes, VIII.B.5.c criteria
4 are used. If the answer is no, you only evaluate the
5 impact on the probability per A-B.5.c. So remember
6 this right here.

7 You only look at the consciences. There
8 is a substantial increase in the consequences to the
9 product of a severe ex-vessel severe accident
10 previously reviewed. So my thought process is really
11 --

12 MEMBER CORRADINI: You are saying
13 something was missed? Is that what you're saying?

14 MR. DUBE: Yes. I mean, it's possible
15 that one would only look at the impact on probability
16 and not the consequences. If, as the AP1000 states,
17 that they have no credible ex-vessel severe accidents,
18 you never ever look -- you only look at the impact on
19 probability and not on consequences. So you only look
20 at on the VIII.B.5.c -- or if the answer was no, you
21 would only evaluate impact on probability for
22 VIII.B.5.c. You never look at the impact on
23 consequences.

24 But that's not the root of real concern.
25 The root of real concern is if the ex-vessel severe

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1 accident diamond, the answer was no, there's no impact
2 or it's not addressing an ex-vessel severe accident
3 feature, that means, then, the change might affect
4 some other severe accident feature. If the answer was
5 no, one would use VIII.B.5.b criteria. The problem
6 with that is the VIII.B.5.b creature is for design
7 basis accidents, not for severe accidents.

8 MEMBER CORRADINI: Okay. I'm really
9 getting long-winded here, but you could have a change
10 to a severe accident feature that's not ex-vessel
11 severe accident. And you would be using design basis
12 accident criteria, not the ex-vessel severe accident
13 criteria. VIII.B.5.b is for design basis accidents.
14 So one would not be asking these questions for a tier
15 2 change to a severe accident feature that's not
16 ex-vessel.

17 The other concern is where I said that if
18 one could make a change to a severe accident feature
19 where one would then be led to use appendix C,
20 4.4.3.2. And that would allow screening out from
21 further review because there's no impact on design
22 basis accidents.

23 An example would be if you had a feature
24 to prevent core damage and it was only in tier 2,
25 there was not a discussion in tier 1. If you go

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1 through the process since it's not there to mitigate
2 an ex-vessel severe accident and it's not there for
3 design basis accident purposes, the guidance would
4 have allowed this, the change, to be screened out and
5 not require any prior NRC approval.

6 Does that logic follow or should I go
7 through it again?

8 MEMBER CORRADINI: Keep on going.

9 MR. DUBE: That's why I said --

10 CHAIR STETKAR: Silence is complete
11 understanding.

12 MR. DUBE: That's why I said in the worst
13 case --

14 CHAIR STETKAR: You could take that
15 approach, too, but --

16 MEMBER CORRADINI: The Venn diagram helped
17 me. After that --

18 CHAIR STETKAR: Yes.

19 MR. DUBE: It's hard to parse an example
20 here.

21 MEMBER BLEY: It's hard to point you
22 without a specific example.

23 MR. DUBE: I'll give an example.

24 CHAIR STETKAR: You've got an example?

25 MR. DUBE: Yes.

1 CHAIR STETKAR: Let's do that.

2 MR. DUBE: The point here is because of
3 the definition of ex-vessel severe accident -- and
4 those criteria only apply to ex-vessel severe
5 accidents -- number one, severe accidents that are not
6 ex-vessel in nature, such as containment bypass, do
7 not have an appropriate set of review criteria
8 commensurate with this for severe accidents.

9 CHAIR STETKAR: For example, if you made
10 your low-pressure --

11 MR. DUBE: Right.

12 CHAIR STETKAR: -- isolation valves out of
13 tissue paper, they probably would not --

14 MR. DUBE: And the only thing that is left
15 since they are not using criteria for severe accidents
16 is design basis accidents. Well, the guidance says,
17 "I'm not using this for design basis accidents."

18 CHAIR STETKAR: So an RHR system is a
19 non-safety-related system.

20 MR. DUBE: Screen out the change. Now,
21 for a number of reasons, a number of these features
22 are in tier 1. And that helps prevents a change that
23 wouldn't get prior NRC approval.

24 CHAIR STETKAR: It's fortuitous.

25 MR. DUBE: Yes. It may be or may not be.

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1 So we did a gap assessment. We reviewed
2 severe accident features for three plants. We found
3 no significant gaps of concern for a number of
4 reasons. Either it's an ex-vessel severe accident
5 feature and VIII.B.5.c criteria would be used for tier
6 2 changes or if it's not a non-ex-vessel severe
7 accident feature, there's enough detail in tier 1 to
8 preclude a significant design change without prior NRC
9 approval. And we're verifying these conclusions.
10 We'll eventually look at the other standard designs.
11 So we have a recommendation 1 to the Commission to
12 fill in this gap.

13 So here is an example why for the ABWR we
14 don't think there is a gap. And here is a concrete
15 example. The ac-independent water addition system
16 provides the ability to flood the lower drywell via
17 drywell sprays. It can also provide injection
18 emergency makeup water to the reactor by
19 cross-connection division C of RHR to the reactor
20 building.

21 The first question is, is it an EVSA
22 feature? Is it an ex-vessel severe accident feature?
23 Well, some of it is, and some of it isn't. Those
24 aspects for flooding the lower drywell via drywell
25 spray meets the definition of ex-vessel severe

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1 accident. And so any change you have to look at the
2 impact on consequences. And in design control
3 documents, there is discussion in tier 1 and tier 2
4 and so forth. So there's enough discussion in tier 1
5 that there is no gap in the change process. And the
6 license holder could evaluate this under A, B.5.c for
7 tier 2 changes. And any tier 1 changes would require
8 NRC approval.

9 But those aspects for injecting emergency
10 makeup water into the reactor is not an ex-vessel
11 severe accident feature. All right? It's not
12 addressing molten debris melting through the bottom of
13 the vessel. Okay? So any change neither impacts
14 probability nor consequence. This feature contributes
15 to severe accident prevention but does not meet the
16 definition of ex-vessel severe accident feature.

17 Fortunately, there is enough discussion in
18 tier 1. And I'll show you an example. A license
19 holder could make very much of a change without
20 impacting tier 1. But if there was no tier 1
21 discussion, only tier 2 -- let's just say
22 hypothetically there was no tier 1 discussion. They
23 could in theory defeat this function and not require
24 prior NRC approval. That's the gap.

25 Now, we went through all of the design

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1 features and made sure that we had either a tier 1
2 discussion in sufficient detail in tier 1 or it was an
3 ex-vessel severe accident feature, that it would get
4 some kind of review.

5 CHAIR STETKAR: You say that's for the
6 currently certified designs?

7 MR. DUBE: Those three designs that I
8 mentioned. And this is why in tier 1 there is a lot
9 of detail. So if they made any change to this
10 paragraph here on this slide, they require prior NRC
11 approval.

12 I won't go through all of it, but it
13 discusses -- you know, it can be used for injecting
14 emergency makeup water. It goes into the detail of
15 having manually opening two in-series valves and a
16 cross-connecting pipe. It's accomplished by local
17 manual action in the valves. Fire protection water
18 can be directed to either the reactor pressure vessel
19 or drywell sprays and so on. So this is a lot of
20 detail that a license holder doesn't have a lot of
21 room to make changes that doesn't impact that.

22 So the long and short of it is yes, there
23 is a gap to the process. It turns out for the three
24 reactor designs that are certified in near
25 certification, there is enough detail in tier 1. It

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1 may be deliberate, but you can't rule out some other
2 new reactor design coming in there and not having
3 enough detail in tier 1.

4 So we'll discuss later this afternoon how
5 we propose addressing this gap in the recommendation.

6 MEMBER REMPE: You said the staff reviewed
7 it. You went back and got each of the design --

8 MR. DUBE: Yes.

9 MEMBER REMPE: -- certification teams
10 involved in everything?

11 MR. DUBE: We got the design control
12 documents and went through every severe accident
13 feature.

14 MEMBER REMPE: And it was the PRA staff or
15 --

16 MR. DUBE: Yes.

17 MEMBER REMPE: -- actually going back and
18 getting the people that were involved in design
19 certification from the NRC staff?

20 MR. DUBE: Just current NRC staff. But
21 we're going to be getting an independent set of eyes
22 to look at it.

23 MEMBER BLEY: Don, when you come back this
24 afternoon, could you take just a few minutes and help
25 clarify for me the definition of the ex-vessel severe

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1 accident design feature? Is it where the accident
2 occurs, which it must be. Just it would help clarify
3 things a bit for me. I'm a little fuzzy on it.

4 MR. DUBE: Okay.

5 CHAIR STETKAR: Anything else?

6 (No response.)

7 CHAIR STETKAR: Don, you did a great job.

8 We are recessed until 1:00 o'clock.

9 (Whereupon, a luncheon recess was taken at
10 12:02 p.m.)

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

2 (1:01 p.m.)

3 CHAIR STETKAR: We are back in session.

4 MR. DUBE: Are there any lingering
5 questions on ex-vessel severe accidents? Again --

6 CHAIR STETKAR: Dennis had asked for a
7 brief synopsis of what those scenarios are.

8 MEMBER BLEY: How you decide some things
9 are ex-vessel severe accident feature.

10 MR. DUBE: Okay. I'll do that.

11 MEMBER BLEY: Does it depend on where the
12 accident begins? What's it about?

13 MR. DUBE: It's defined in the statement
14 of considerations.

15 MEMBER BLEY: Yes.

16 MR. DUBE: A feature of where the intended
17 function of the design feature is relied upon to
18 resolve postulated accidents when the reactor core has
19 melted and exited the reactor vessel and the
20 containment is being challenged.

21 MEMBER BLEY: Okay.

22 MR. DUBE: So something like a BiMAC on
23 ESBWR, which is a core-catcher in fancy terms, is an
24 ex-vessel severe accident feature.

25 Some aspects of squib-activated

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1 depressurization valves in the ESBWR, those aspects
2 related to preventing high-pressure melt ejection to
3 be an ex-vessel severe accident. Those aspects for
4 design basis accident mitigation -- I mean, that's
5 just part of the pressurization -- are not. Now,
6 fortunately, I mean, it's hard to separate the two.

7 MEMBER BLEY: It strikes me that
8 nine-tenths of your problem is due to definition. We
9 didn't even need that.

10 MR. DUBE: And I mentioned the containment
11 venting would be an ex-vessel sever feature. But the
12 fire water addition system in ESBWR for flooding the
13 lower dry well should the core become damaged and
14 relocate into the containment --

15 CHAIR STETKAR: Is.

16 MR. DUBE: -- is.

17 CHAIR STETKAR: But not to prevent core
18 damage.

19 MR. DUBE: Yes, in the ABWR not to prevent
20 core damage. So you see the trap that we, plural we,
21 worked ourselves into, those features specifically to
22 address the accidents when the molten debris has
23 exited the vessel are captured by this change process.
24 Some of these are preventing core damage. And they're
25 not safety-related. The added-on features like this

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1 are not. So where do they lie? They don't have a
2 happy home for a change process. And that's where the
3 gap is.

4 Now, because a lot of these things are in
5 tier one, you know, we don't believe --

6 MEMBER BLEY: And it doesn't matter.

7 MR. DUBE: Maybe it's a moot point, but,
8 you know, who is to say somewhere down the line some
9 new reactor comes in, the line comes in and --

10 MEMBER SHACK: I assume that you will
11 check to make sure that --

12 MR. DUBE: Yes. We will. And we'll talk
13 about the recommendations on that. I mean, I know we
14 have a sort of recommendation. NEI has a little bit
15 of a difference of opinion on that.

16 So I hope that helped. You know, I have
17 other examples on other designs, but that's the
18 definition, the working definition.

19 Do you want me to put it through for you,
20 Ron?

21 MR. FRAHM: Yes, please.

22 MR. DUBE: So unless there are other
23 questions, we will move on to ROP. We will touch upon
24 some of these other topics again when I -- after ROP,
25 I'm going to wrap it up with the basic conclusions and

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1 the Commission paper, recommendations, and summary.
2 But I think we are ready to move on to ROP if that is
3 okay, Mr. Chairman.

4 CHAIR STETKAR: That is wonderful.

5 MR. FRAHM: I hope you still feel that way
6 in a few minutes.

7 7. REACTOR OVERSIGHT PROCESS TABLETOP EXERCISES

8 MR. FRAHM: Good afternoon. I am Ron
9 Frahm. I'm in the Performance Assessment Branch in
10 NRR. And I have the lead for the ROP portion of the
11 tabletop exercises.

12 And I did want to acknowledge that Rani
13 Franovich, the Branch Chief for the Performance
14 Assessment Branch, is with us this afternoon as well,
15 as is Steve Vaughn, our lead for the significance
16 determination process. So all hard questions will be
17 forwarded over to that side of the room.

18 Well, we talked quite a bit about
19 licensing tabletops. So we also ran several tabletops
20 on the risk-informed aspects of the ROP. I did want
21 to go into a little bit of ROP background and
22 framework to kind of set some context and perspective
23 on the ROP and how it all fits together. And then I
24 plan to go through and discuss the existing
25 risk-informed guidance for those risk-informed aspects

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1 of the ROP, those being the significance determination
2 process, mitigating systems performance index, and the
3 management directive 8.3 for event response.

4 Then next I'll go over the approach that
5 we use to perform these tabletop exercises, but the
6 real focus of today's discussion will be on the
7 results and the conclusions from the tabletops.
8 You'll see there are several slides on that.

9 And then, lastly, we'll present the ROP
10 options and recommendations, but I believe we will
11 actually do that in a later session, where we talk
12 about the Commission paper itself.

13 With that little bit of ROP 101,
14 background on the ROP, it was first implemented in
15 April of 2000. So we place the previous oversight
16 processes, which we believed to be a little bit too
17 subjective and unpredictable. And one of the primary
18 objectives of the ROP was to improve the objectivity
19 of oversight and minimize the subjectivity in our
20 decision-making.

21 Another important objective was to improve
22 the scrutability of our actions. And I'm not sure if
23 we invented that word "scrutability" or not, but what
24 it really means is to make our actions understandable
25 and predictable. And our regulatory responses would

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1 have a clear tie to licensee performance.

2 Another key objective and really the
3 integral part of today's discussion is that the ROP be
4 risk-informed and that the NRC and licensee focus on
5 the issues with the greatest impact on safety.

6 This next slide provides the ROP
7 framework. And I really wanted to put this up to
8 demonstrate that there are seven cornerstones of
9 safety that go through two-thirds down the page there.
10 And these cornerstones support the strategic
11 performance areas of reactor safety, radiation safety,
12 and safeguards, which, of course, support the NRC's
13 mission to protect public health and safety. The
14 seven cornerstones are initiating events, mitigating
15 systems, barrier integrity, emergency preparedness,
16 public and occupational radiation safety, and
17 security.

18 CHAIR STETKAR: Ron, be careful. The mike
19 is real sensitive.

20 MR. FRAHM: Oh, okay.

21 CHAIR STETKAR: It kind of explodes --

22 MR. FRAHM: Thank you.

23 CHAIR STETKAR: -- in people's ears here.

24 MR. FRAHM: Thank you.

25 Okay. Moving on to this next slide, what

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1 I wanted to show here is that within each of those
2 seven cornerstones, there are objectives that need to
3 be met to indicate that the licensees are safe within
4 the boundaries of the cornerstone. And we do that
5 through two different means that are equally weighted.

6 We have NRC inspections. We have
7 performance indicators that are submitted by the
8 licensees. This data is run through our significance
9 determination process for inspection findings and then
10 predetermined thresholds for the performance
11 indicators.

12 And based on the level of significance,
13 they get colors. Green is the best. Then
14 progressively white, yellow, and red are more
15 safety-significant. Then these inputs feed the ROP
16 action matrix there in the middle in the pink.

17 And based on the column in that ROP action
18 matrix, I hope everybody is familiar with what that
19 looks like. I did not have a slide on that. But
20 based on the column in that action matrix, that will
21 determine our regulatory response. And one of the
22 keys here is that that regulatory response is
23 predictable. You can see exactly why we're doing what
24 we're doing, why we're doing this.

25 And if we were to deviate from the column

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1 in that action matrix, we would have to get approval
2 from the EDO to deviate. And that's intended to be
3 very rare. I think over the 12 years of the ROP, it's
4 been done 18 to 20 times maybe. So we try to be very
5 predicable and repeatable, et cetera, understandable.

6 MEMBER SIEBER: When the EDO approves an
7 exception, is that to be more severe or less severe?

8 MR. FRAHM: Either way. We have gone both
9 ways.

10 MEMBER SIEBER: Out of the 18 times it's
11 been done, how many times did you --

12 MR. FRAHM: I don't --

13 MS. FRANOVICH: We can go back and check,
14 but based on my recollection, I would say maybe 20 to
15 25 percent of the time it's to have a regulatory
16 response that's less than what would be detailed by
17 the action matrix.

18 MEMBER SIEBER: Okay.

19 MS. FRANOVICH: We can give you some
20 specifics. We'll follow up with that.

21 MEMBER REMPE: Could you just give one
22 example?

23 MR. FRAHM: I would say that is fair.
24 Let's see. A good example of a deviation:
25 groundwater contamination at Indian Point.

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1 That didn't trip any thresholds, but we
2 felt we needed to do a little bit more than what the
3 action matrix would have told us to do. So region 1
4 requested a deviation. The EDO approved the deviation
5 to go and do the additional inspection.

6 MEMBER SIEBER: So 25 percent of these
7 decisions lead to lower and 75 percent lead to
8 increases?

9 MR. FRAHM: That's pretty solid math.

10 (Laughter.)

11 MR. FRAHM: I would say yes. And we're
12 guessing at those number. I would say somewhere
13 between a quarter and a half. I'd say it's more
14 likely to increase regulatory response than -- based
15 on my recollection and experience.

16 MS. FRANOVICH: Or at least that's the
17 historical precedent that we're aware of.

18 MR. FRAHM: Right.

19 MEMBER SIEBER: Thank you.

20 MR. FRAHM: Sure. Okay. Moving on, I
21 want to provide a little bit of the guidance on each
22 of the three main risk-informed aspects of the ROP.
23 For the SDP, the process is described in IMC-0609.
24 And that really focuses on the cornerstones of
25 initiating events, mitigating systems, and barrier

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1 integrity. I'm sorry. Appendix A of 0609 focuses on
2 those cornerstones. And that's really the
3 risk-informed aspect of the SDP. A lot of the other
4 SDPs are a little more deterministic in EP and public
5 radiation safety, et cetera.

6 And the risk thresholds are a function of
7 changes in CDF and LERF against the plant's baseline
8 risk. That's all I wanted to say there.

9 CHAIR STETKAR: He's coming across the
10 table.

11 MR. FRAHM: Okay. For mitigating systems
12 performance index, that guidance for all PIs is
13 contained in IMC-0608, which, of course, includes
14 MSPI. But the real details of the PI guidance are
15 contained in NEI 99-02, which is controlled by
16 obviously NEI and the industry. But we meet on a
17 periodic basis and agree on the content of that
18 document.

19 The MSPI does cover five systems that are
20 important to safety. And, of course, they are all in
21 a mitigating systems cornerstone. They use a
22 calculation to track the availability of the monitored
23 trains and the reliability of the monitored components
24 within these safety systems. The MSPI reflects the
25 deviation of a specific unit's performance from an

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1 industry baseline and converts that into a simplified
2 change in CDF.

3 In addition to the risk calculation, there
4 is a performance limit or a deterministic backstop
5 that's used for determining grade, performance. And
6 exceeding this limit in any one of the MSPI indicators
7 would result in a white indicator.

8 CHAIR STETKAR: Ron, I have to admit
9 ignorance here. Are there five specific systems that
10 apply to everyone because I think it must because --

11 MR. FRAHM: P's and G's are a little bit
12 different.

13 CHAIR STETKAR: What are those systems?
14 We have MSPI review but --

15 MR. DUBE: Emergency AC power, heat
16 removal. So it's either for the PWRs it's emergency
17 feedwater, aux feedwater, or RCIC for BWR, high
18 pressure injection, residual heat removal, and then
19 something called cooling water. So that may be
20 actually a combination of service water, component
21 cooling water. Some plants have raw water. So all
22 the cooling waters are going to wind up in the --

23 CHAIR STETKAR: Thank you.

24 MR. FRAHM: Okay? Moving on to event
25 response, that implementation guidance is in

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1 management directive 8.3 with supplemental guidance in
2 inspection manual chapter 03.09 for determining our
3 response to events.

4 The risk-informed thresholds used for
5 determining which reactive inspection to perform are
6 a function of CCDP, conditional core damage
7 probability, and conditional large early release
8 probability.

9 And there is an overlap within these
10 options based on the uncertainty and deterministic
11 insights that provide a little bit of flexibility in
12 determining an appropriate response. And there is
13 also additional deterministic criteria that is
14 reviewed and documented as the basis for our decision
15 within that overlap region. And I'll attempt to
16 demonstrate this on an upcoming slide. In fact, it is
17 the next slide.

18 So on this slide, what I did, I actually
19 put this together myself based on the three guidance
20 documents to try to give a one size fits all
21 demonstration of the risk aspects of the ROP. And
22 you'll see the SDP in the thresholds on the left, MSPI
23 in the middle. And the asterisk on the white there is
24 based on the performance limit that I talked about.
25 If that performance limit is reached, you are

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1 automatically white for MSPI.

2 And then if you look at MD 8.3, you'll see
3 there is a range for the IIT and the is and the AIT.
4 So based on your risk number, if you fall within a
5 range that crosses two of the different types of
6 reactive inspections, you can select the inspection
7 based on uncertainties and deterministic insights.

8 MEMBER SKILLMAN: Ron, may I ask you to go
9 back one slide, please, to the second bullet,
10 regarding reactive inspections? What assures that the
11 NRC's calculation, condition of core damage
12 probability and LERF and the licensee's calculation of
13 those two parameters, are essentially the same number?

14 MEMBER SIEBER: They aren't.

15 MS. FRANOVICH: This is Rani Franovich
16 from NRR staff.

17 I don't know that we seek input from
18 licensees on reactive inspections. I think that that
19 is purely an NRC-generated decision-making insight.
20 When it comes to significance determination process,
21 we do engage with licensees and have enforcement
22 conferences, receive information on the docket that
23 they like to provide to inform our risk-informed
24 decision, but when it comes to reactive inspections,
25 the same process does not apply.

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1 MEMBER SKILLMAN: Thank you. Thanks.

2 MEMBER SIEBER: Your basic decisions are
3 based on SPAR models, right?

4 MR. FRAHM: I believe. I believe so.

5 MR. DUBE: Fundamentally, yes.

6 MEMBER SIEBER: Yes. Right.

7 MS. FRANOVICH: Thanks, Don.

8 MR. FRAHM: Okay. That's really all I had
9 on this slide. We may want to come back to it when we
10 go over some of the examples.

11 Now to get into the actual tabletops
12 themselves. They were conducted on October 5th and a
13 follow-up meeting on October 26th, as Don previously
14 noted. And, similar to the licensing tabletops, we
15 tested various realistic scenarios. We wanted them to
16 be realistic. In fact, the SRM required that they be
17 realistic to confirm the adequacy of the ROP
18 risk-informed processes or to identify areas for
19 improvement and address any noted gaps.

20 We developed several examples across a
21 broad cross-section of well-vetted cases, actual cases
22 across several designs and vintages and developed from
23 these actual examples, we ran through SDP, MSPI, and
24 MD 8.3 case studies.

25 We applied similar situations to the new

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1 reactor designs and then filled in some gaps and
2 inconsistencies with the designs with some realistic
3 hypotheticals and reasonable assumptions. And then we
4 compared the risk values and resultant regulatory
5 response to ensure that we're in the right place.

6 And a summary of these case studies was
7 included as an enclosure to the October 26th meeting
8 minutes. So it should be in your packages. And that
9 was actually distributed ahead of time before the
10 tabletops so that folks could digest it and come to
11 the tabletops with some informed insights.

12 So the first set of tabletops that I would
13 like to talk about today was the SDP tabletops. They
14 did indicate that the existing risk thresholds for
15 determining the significance are adequate. I think
16 it's safe to say that some of us were surprised at the
17 fact that we were able to get several greater than
18 green findings, even given the more robust designs for
19 the new reactors.

20 The tabletops demonstrated that these
21 thresholds could be crossed and produce a regulatory
22 response, but they were limited primarily to common
23 cause failures across multiple safety systems or long
24 exposures of risk-significant components.

25 We found that the existing process does

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1 not always ensure an appropriate regulatory response
2 for the degradation of passive components and
3 barriers. And I'll discuss an example on the next
4 slide.

5 We concluded based on these tabletops that
6 the SDP analyses could be augmented with additional
7 qualitative considerations, such as deterministic
8 backstops, to ensure the NRC appropriately addresses
9 performance issues.

10 And these preliminary results and
11 conclusions were really kind of discussed and agreed
12 to, for lack of a better term, at that October 26th --

13 CHAIR STETKAR: Ron, before you go to the
14 vessel head one, which I think we want to understand,
15 I went through the examples. And you mentioned that
16 the conclusion was that if you applied enough common
17 cause failures or applied a long enough exposure
18 period, you transcended the greater than green
19 thresholds.

20 I wanted to ask you a question about --
21 one of the examples was high-pressure core flow, ABWR.
22 And you ran two exercises: one where you took out one
23 high-pressure core flood pump. And this apparently
24 occurred at the Perry plant and was a white finding,
25 I think.

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1 And for the ABWR, it didn't even close to
2 exceeding green. If you took out both high-pressure
3 core flood pumps, you just made it over and above the
4 green.

5 Question I had -- and this will be
6 pertinent later. You may not have it at your
7 fingertips, but you might be able to bring to bear
8 someone who could have it. What was the percentage
9 change in the Perry core damage frequency for the
10 actual event? And what was the percentage change in
11 the ABWR core damage frequency for the same goal,
12 high-pressure core flood pump?

13 MR. FRAHM: That I could not answer for
14 you. I'm not sure if anybody is here that --

15 MS. FRANOVICH: Don, do you have that
16 information in the tabletop exercise summary that
17 you've got there or do you --

18 CHAIR STETKAR: The summaries do not. I
19 could have calculated in my -- I know what the delta
20 is in an absolute sense is, but I don't know what the
21 denominator is.

22 MR. DUBE: I am going to take a good
23 judgment call here. In the Perry case, the delta CDF
24 was 5E-6, right?

25 CHAIR STETKAR: That is correct, yes.

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1 MR. DUBE: Apart from the fact that it was
2 for 23 days, you increase 5E-6 from some baseline.
3 And then you integrate that over 23 days is how you
4 get the change in core damage probability, convert
5 from change in core damage frequency to a core damage
6 probability by multiplying by the exposure time. But
7 I am going to take a good engineering judgment guess
8 that 5E-6 per year change in core damage frequency is
9 50 percent or even somehow of the order of 50 percent,
10 100 percent --

11 CHAIR STETKAR: I am just looking for, you
12 know --

13 MR. DUBE: Yes.

14 CHAIR STETKAR: If you had it precise,
15 that's great, but --

16 MR. DUBE: I mean, typical BWRs of this
17 vintage have baseline internal CDFs in the -- the best
18 are in the low to mid to the -6 and to the low to the
19 -5. So, I mean, this is the kind of --

20 CHAIR STETKAR: Any sense for the ABWR
21 example? Take the comparable single high-pressure
22 core flood pump for 23 days. Don't extend it out to
23 the year.

24 MR. DUBE: Well, you know, the baseline
25 CDF for the ABWR internal events I am pretty familiar

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1 because we ran those models. These are like something
2 around three or four E-7 internal events. And we said
3 that we're not delta over one year 2.2E-7. So it's --

4 CHAIR STETKAR: Yes. But, just for the
5 record, I'm asking for the comparable 23-day, which is
6 1.4E-8.

7 MR. DUBE: Yes. 1.4E-8 is the change of
8 core damage probability. So that's --

9 CHAIR STETKAR: Frequency.

10 MR. DUBE: Well, 23 days would be core
11 damage probability.

12 CHAIR STETKAR: I think it was frequency
13 in the tabletop, wasn't it?

14 MR. DUBE: You take the delta CDF times
15 time. You end up with a core damage probability. I
16 know it says delta CDF here, but that's really a --

17 CHAIR STETKAR: It's important to get
18 units consistent.

19 MR. DUBE: Yes. Any time you multiply a
20 --

21 CHAIR STETKAR: I don't care how you did
22 the calculation. I'm asking for the ratio of whatever
23 it was over 23 days to whatever the baseline was over
24 23 days if that's what you want to give me.

25 MR. DUBE: Yes.

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1 CHAIR STETKAR: I can take it in frequency
2 divided by frequency. I can take it in integrated
3 probability divided by integrated probability.

4 MR. DUBE: During that time, the core
5 damage frequency went up roughly 50 percent due to
6 internal --

7 CHAIR STETKAR: About 50 percent? Thanks.
8 Thank you. Now we can talk about that. I'm sorry.

9 MR. FRAHM: Thanks. Okay. The best
10 example that supported our conclusion was the case
11 that involved the vessel head degradation, which
12 resulted in a marginally white finding for the AP1000
13 and a green finding for the ABWR based on the risk
14 numbers.

15 And, in fact, I wanted to point out that
16 the draft of the paper that was forwarded to the ACRS
17 actually had this reversed. It was a mistake. We
18 noted it after we forwarded the paper out. And it was
19 actually the AP1000 that had the marginally white and
20 not the APWR. So we'll make that change, obviously,
21 before we send the paper to the Commission.

22 As we know in the ROP, the resultant
23 regulatory response based on a white finding is to
24 just go in the regulatory response column and perform
25 a 95001 inspection, which is really a pretty focused

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1 inspection of about 40 hours or so, I believe.

2 And then for the green finding at the
3 APWR, we would do no additional inspection. So, as
4 the last bullet states, we believe that a more robust
5 and diagnostic supplemental inspection, such as a
6 95002 or a 95003 team inspection, which would
7 correspond with columns 3 and 4 of the ROP action
8 matrix, would give us a better idea that the root
9 causes and degradation are adequately identified and
10 corrected.

11 CHAIR STETKAR: Ron, I am going to ask you
12 the same question about this. Do you have a sense of
13 what percentage increase in core damage frequency for
14 both US-APWR and AP1000 or US-APWR if that's the only
15 green one because that's sort of the flag for concern?

16 MR. FRAHM: I do not, but hopefully my
17 friend and colleague Mr. Dube does.

18 MR. DUBE: Okay. What now? The AP1000?

19 CHAIR STETKAR: Well, US-APWR on the
20 slide, the corrected slide here, was the one that
21 didn't transcend the green. So I guess I'm more
22 interested in that one.

23 MR. FRAHM: It did not transcend to white?

24 CHAIR STETKAR: Did not transcend to
25 white. While you're looking that up, Ron --

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1 MR. DUBE: Their baseline internal event
2 CDF is 10-6. So it's like a 14 percent increase.

3 CHAIR STETKAR: About a 14 percent.

4 MR. DUBE: For the APWR.

5 CHAIR STETKAR: About a 14 percent?

6 MR. DUBE: Yes.

7 CHAIR STETKAR: Okay.

8 MEMBER SHACK: What did those turn out to
9 be for conventional PWRs? White?

10 MR. DUBE: Red.

11 MEMBER SHACK: Red?

12 MR. FRAHM: Red for the similar case at
13 Davis-Besse a few years back.

14 CHAIR STETKAR: Why in this case, as I
15 understand it -- I'm not familiar with all of the
16 guidance. I'm not familiar with any of the guidance,
17 to be more precise, for these calculations. When I
18 was reading the summary, it said that you basically
19 took this event and increased both the medium and
20 large LOCA frequencies by two orders of magnitude. Is
21 that right? Okay. And that's some --

22 MR. DUBE: We did that because that is
23 what was done for Davis-Besse originally.

24 MR. FRAHM: Right.

25 MR. DUBE: So we were consistent with --

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1 CHAIR STETKAR: Yes. No. I --

2 MR. DUBE: We can argue whether that is --

3 CHAIR STETKAR: What I was going to ask is

4 --

5 MR. FRAHM: But it is within process.

6 MR. DUBE: Yes.

7 CHAIR STETKAR: What I was going to ask is
8 some plants are more forgiving of large LOCAs than
9 they are of small LOCAs. So does the process also
10 address this type of event as a small LOCA
11 vulnerability?

12 MR. DUBE: No. We just increased the
13 medium and large LOCA initiating event frequencies.

14 CHAIR STETKAR: Okay. Okay. I mean, that
15 was more of a process question. I had no idea how it
16 would come out.

17 MR. DUBE: We wanted to do as much of an
18 apples to apples comparison --

19 CHAIR STETKAR: No. I understand. If
20 that's what you did for Davis-Besse, --

21 MR. DUBE: Yes.

22 CHAIR STETKAR: -- that's what you should
23 do for this example. Just when I was looking at it,
24 it struck me that you didn't look at the delta risk
25 from small LOCAs, which is not at all clear.

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1 MR. DUBE: Right.

2 CHAIR STETKAR: You know, I had no idea
3 how that would fit into the --

4 MR. DUBE: Yes. They have a lower
5 condition of core damage probability. So it might
6 have changed the conclusion a little bit. It would
7 have been more green than --

8 CHAIR STETKAR: Well, I'm sorry. Some
9 advanced designs --

10 MR. DUBE: Yes.

11 CHAIR STETKAR: -- I think can handle
12 large LOCAs and medium LOCAs better than they can
13 handle small LOCAs. There are more things that have
14 to happen to --

15 MR. DUBE: Yes. I don't --

16 CHAIR STETKAR: Okay. That was more of a
17 curiosity.

18 MR. DUBE: Yes.

19 CHAIR STETKAR: Thank you.

20 MR. FRAHM: Okay? Moving on, we did
21 identify some potential deterministic backstops as a
22 result of these tabletops -- and we did mention these
23 in the draft Commission paper -- to potentially
24 explore further in the upcoming months or years to
25 identify the shortfalls, assuming the Commission goes

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1 with our recommendations. But these backstops will be
2 consistent with the deterministic criteria in reg
3 guide 1.174, defense-in-depth, maintain safety
4 margins, et cetera.

5 And one example is that we could have a
6 potential backstop that could be developed to
7 emphasize the importance of maintaining barrier
8 integrity for the fuel cladding, RCS pressure
9 boundary, and containment.

10 Another possibility would be to
11 potentially address the extensive equipment outage
12 times resulting from degraded conditions, similar to
13 the RITS 4b backstop completion time that was
14 discussed I guess actually last time during that
15 tabletop.

16 Another potential backstop could be to
17 address repetitive equipment failures that could
18 degrade the reliability or availability of important
19 systems from performing their intended functions.

20 And, regardless, it is important to note
21 that and really emphasize that these backstops would
22 be designed to capture the infrequent, yet potentially
23 significant performance issues that would not
24 otherwise be captured by the risk calculations to
25 ensure that we take the appropriate regulatory

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1 response.

2 The goal here isn't to get more whites,
3 reds, and yellows. The goal is to make sure that we
4 don't miss anything and that we're looking at all
5 available information to make an informed decision.

6 The example -- I'm sorry. Moving on to
7 the MD 8.3 tabletops, these tabletops demonstrated
8 that the existing risk thresholds for invoking
9 reactive inspections would be adequate. And the
10 deterministic criteria already does play an important
11 role in the determination of event responses.

12 The tabletops did reveal, though, that
13 deterministic criteria are used initially for event
14 screening and then considered again within a range of
15 response determined by risk values, as I pointed out
16 earlier. So these risk values actually heavily
17 influence whether or not a reactive inspection is
18 warranted and, if so, at what level.

19 So, lastly, the tabletops revealed that
20 variations in or minor revisions to the risk models
21 used can potentially result in a different and
22 potentially inadequate response.

23 MEMBER ABDEL-KHALIK: If we look at the
24 first bullet, if everything sort of comes out green or
25 if the majority of things turn out green, how would

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1 that sea of green help you?

2 MR. FRAHM: Well, for one, they did not in
3 this case. For the event responses, we actually were
4 able to hit AITs and more intense follow-up
5 inspections.

6 MEMBER ABDEL-KHALIK: Comparatively
7 speaking, these are very severe scenarios.

8 MR. FRAHM: But keep in mind, too, these
9 are events, not inspection findings. So they're not
10 color-coded with green, white, yellow, red. So we
11 would go to that chart that Don just pulled up.

12 Based on the CCDP, we would see where we
13 fall in the chart and then pick from available options
14 based on the range.

15 MS. FRANOVICH: This is Rani Franovich.

16 If I could just add that I think that that
17 is the basis for the staff's recommendation that we
18 not let the risk values overly influence our
19 decision-making with respect to regulatory response?
20 So you'll see in the staff's proposal that because we
21 consider these to be heavily influenced by risk
22 values, the deterministic considerations are going to
23 help us achieve an appropriate regulatory response in
24 a risk-informed framework if that helps answer your
25 question.

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1 MEMBER ABDEL-KHALIK: I fully understand.
2 I am just sort of concerned that this would render
3 this process irrelevant because you always fall back
4 to the deterministic back side.

5 MS. FRANOVICH: Potentially. But the
6 tabletops did not indicate that that would be the
7 case. The tabletops indicated that risk thresholds
8 would, similarly, be tripped using realistic scenarios
9 from events we responded to with the current fleet and
10 translating those to comparable scenarios for a new
11 reactor design. white or green, depending on the
12 reactor design

13 MEMBER ABDEL-KHALIK: If you look at the
14 example that we just looked at with the vessel head
15 degradation, the comparison was that it was red.

16 MS. FRANOVICH: Agreed. Agreed.

17 MEMBER ABDEL-KHALIK: It turned out to be
18 either white or green depending on the reactor design.
19 So you're not comparing apples and --

20 MS. FRANOVICH: So let me try to explain.
21 It's a very good question. When it came to the
22 management directive 8.3 reactive inspection
23 decisions, all of the scenarios we looked at, as I
24 recall, indicated that we would, similarly, have a
25 reactive inspection for a new reactor.

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1 The vessel head degradation scenario was
2 one that was used for significance determination
3 process, --

4 MEMBER ABDEL-KHALIK: Right.

5 MS. FRANOVICH: -- not management
6 directive 8.3. But we recognized from that example
7 the potential that the risk values would not lead us
8 to the appropriate regulatory response, which is why
9 we think those deterministic considerations will
10 potentially be helpful to us but not always.

11 There will be times when the risk
12 thresholds will also get us there based on the
13 tabletops for 8.3. Based on the tabletops for SDP, we
14 recognize that it may not always get us there.

15 MR. FRAHM: Much less frequently and less
16 likely.

17 MR. DUBE: If I could generalize, it
18 seems, the numerical risk thresholds seem, to work
19 very well for mitigating system failures, let's just
20 say, for SDP but not so much for barriers. And that's
21 where often found the disconnect, for significant
22 barrier degradation.

23 MEMBER BLEY: Barriers are your
24 defense-in-depth.

25 MR. DUBE: Yes, right.

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1 MEMBER BLEY: So that's not a surprise.

2 MR. FRAHM: And that's why we --

3 MEMBER BLEY: I guess I am a little
4 uncomfortable with the --

5 CHAIR STETKAR: I would like them to get
6 through that. I would like them to get through the
7 MSPI because there are a couple of examples. And then
8 I think we should come back and discuss some of this
9 a little bit more, only because it's only a couple of
10 slides and the MSPI is a little bit different than
11 everything.

12 MR. FRAHM: Okay. It is actually the most
13 straightforward.

14 CHAIR STETKAR: That's why I wanted to get
15 through these two slides, so we can come back and have
16 a --

17 MR. FRAHM: Just real quick, the
18 conclusion on the MD 8.3 was that the contribution of
19 the existing criteria could be modified, as we
20 discussed, or new criteria could be developed similar
21 to that that we presented on a previous slide for the
22 SDP.

23 So, to go through the case study example,
24 this really demonstrates the over-reliance on the risk
25 numbers. And that over-reliance might put us in the

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1 wrong place and not result in the adequate regulatory
2 response that we would expect.

3 So in this example, for steam generator
4 tube rupture in AP1000, we originally used a submitted
5 Westinghouse PRA. And that indicated that only a
6 special inspection could be performed in accordance
7 with the guidance because it fell below the 1E-5,
8 which did not take you up into considering an AIT.

9 And then for the ROP tabletops, though, we
10 actually used the more conservative SPAR model. And
11 that resulted in just crossing that threshold so that
12 we would be able to consider an is or an AIT based on
13 the uncertainties and the deterministic factors.

14 So this over-reliance on risk really could
15 put us in the wrong place. And there's no real reason
16 for it.

17 CHAIR STETKAR: I am going to challenge
18 you really strongly on this one because I read those
19 things and neither of the PRA models have been
20 reviewed for technical adequacy for this application.
21 You're comparing results from two preliminary
22 unreviewed, incomplete PRA models and drawing some
23 fundamental conclusion about the adequacy of risk
24 indices based on that comparison. And that is not
25 fair. It's not valid. It's not fair.

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1 One must presume that any risk models --
2 and this comes back a bit to what Dick had asked --
3 any risk models used for input to regulatory decision
4 processes ought to, ought to, satisfy some minimal
5 quality requirements. They ought to be consistent
6 with reg guide 1.200, as will every PRA that is
7 produced prior to fuel load for the new reactors, as
8 would I hope, although they are not, the SPAR models.

9 So comparing two numbers that come out of
10 two equally bad PRAs and drawing a conclusion that you
11 can't use risk numbers for anything is absurd. And
12 I'll use that word. It's absurd. And I want some
13 feedback on that.

14 MR. DUBE: I don't think anybody from
15 Westinghouse would defend it, but, you know, I don't
16 -- I mean, I --

17 CHAIR STETKAR: Their model, by the way,
18 hasn't been through the peer review process. So I'm
19 not --

20 MR. DUBE: I mean, it at least meets their
21 quality assurance. It doesn't meet, you know, fully
22 met, reg guide 1.200.

23 CHAIR STETKAR: That's what I was talking
24 about.

25 MR. DUBE: Yes. For this particular

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1 scenario, the conditional core damage probabilities
2 were very, very close and within a factor of two.
3 Given the uncertainties, I would say that is pretty
4 darned good.

5 Now, it just turns out because of the
6 nature of hard and fast thresholds, one happened to be
7 below and one happened to be above.

8 CHAIR STETKAR: I am using this exercise
9 to say that we really can't rely on risk numbers.

10 MR. DUBE: That may be strong words. That
11 may be strong words.

12 MR. FRAHM: We don't want to base our
13 decision solely on risk numbers.

14 CHAIR STETKAR: We don't want to base them
15 solely on risk numbers, but we don't want to
16 necessarily abandon risk as --

17 MR. FRAHM: We're not suggesting that, no.

18 CHAIR STETKAR: -- we go through the
19 process.

20 MR. DUBE: See, I had done similar
21 calculations some time ago. And what we found was
22 that the conditional core damage probability for the
23 new reactor designs for steam generator tube rupture
24 are about an order of magnitude lower than for the
25 current. Just given a steam gen. tube rupture was a

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1 condition because that is more means of mitigation.

2 So naturally --

3 CHAIR STETKAR: And they tend to have more
4 loops.

5 MR. DUBE: Yes. So naturally you might be
6 doing an augmented inspection for tube rupture at a
7 current reactor. It might fall into the special
8 inspection only for a new reactor. But the real
9 question is, why would you -- given a number of
10 concerns, the fact is you have reached the reactor
11 coolant system barrier. And this is what I said
12 earlier about barriers.

13 You know, this is probably a case where
14 you probably would expect to treat a tube rupture at
15 a new reactor design. Probably the responses should
16 be the same as a tube rupture at a current plant. I
17 mean, you've got an off-site dose release, you know,
18 maybe not a significant exposure, but people get upset
19 about a little tritium in the air. And you would
20 expect the staff's response to be virtually identical
21 and probably should override the calculated core
22 damage probability.

23 CHAIR STETKAR: And that is fine. And I'm
24 not arguing with that. All theatrics aside, that is
25 consistent with the basic framework in reg guide

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1 1.174, the multiple defense-in-depth barriers and so
2 forth.

3 On the other hand, using examples like
4 this to say that we don't have any confidence in risk
5 numbers or that we ought not to rely on them is pretty
6 condemning of the whole notion of quantitative risk
7 information as not the basis, the basis, but input to
8 that decision process.

9 MS. FRANOVICH: This is Rani Franovich.

10 Let me interject here and be very clear.
11 I don't think that the staff has expressed a lack of
12 confidence in the RITS numbers. They are what they
13 are. What the staff has articulated is they may not
14 get the regulator to the right level of response if
15 that's the only consideration.

16 CHAIR STETKAR: Okay. I am sorry, Dennis.
17 I cut you off, as usual.

18 MEMBER BLEY: Yes, you did. You know, I
19 have read that as well. And hearing the discussion
20 here, I don't care what you say. The way it's
21 written, the way you talk, it sounds like this
22 over-reliance is really saying "We don't trust this
23 stuff much at all. Oh, and sometimes it works out
24 that the RITS numbers are helpful."

25 Now, most of the time it does. I think it

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1 would be very helpful. And I think it links to
2 everything else that's out there to tie this to
3 barriers. I think barriers are there for
4 defense-in-depth.

5 CHAIR STETKAR: Right.

6 MEMBER BLEY: That's where they come from.
7 And the reasons you want to elevate an example this is
8 because you are breaching a barrier.

9 CHAIR STETKAR: Right.

10 MEMBER BLEY: That's perfectly reasonable,
11 but that doesn't --

12 CHAIR STETKAR: That doesn't condemn the
13 risk values.

14 MEMBER BLEY: Yes. And you say it's not
15 condemning, but the tenor of this sounds like "Oh,
16 we're just getting too wrapped up in risk." There are
17 some places where, in fact, that's not -- the
18 defense-in-depth is the key issue. And you can find
19 those things.

20 And, rather than -- I also agree a bit
21 with John that these aren't the risk assessments you
22 have used for risk-informed applications. Yet, you
23 are kind of right for the specific case you are
24 looking at, it probably won't be much different.

25 But, again, the barriers it seems to me

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1 can be a challenge to the defense-in-depth. And I
2 don't know anywhere, at least in the last many years,
3 where anything from the Commission or the staff has
4 backed away from defense-in-depth. Well, I know of
5 one.

6 CHAIR STETKAR: Except they said for that
7 one --

8 MS. FRANOVICH: Let me respond again. I
9 think what I'm hearing is violent agreement. That's
10 what I'm hearing because I think that is exactly the
11 way the staff sees it.

12 MEMBER BLEY: It isn't the way the staff
13 has talked to us. And it isn't the way the letter
14 reads.

15 MS. FRANOVICH: Okay. Well, maybe we need
16 to go back and look at the way we have crafted the
17 letter, but if we can get to the conclusions and the
18 proposal, I think we can revisit whether or not we are
19 that far off from each other.

20 MR. FRAHM: This discussion actually
21 supports our conclusions, I believe.

22 MS. FRANOVICH: Yes.

23 CHAIR STETKAR: Let's see if we can get
24 through the MSPI ones. And then I do want to come
25 back to this notion because I want to ask you a

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1 question that is sort of an overriding general
2 question before we get into the details on the letter,
3 you know, the Commission paper itself.

4 MR. FRAHM: And I can't find it in the
5 paper itself, but I know it was in the minutes or I
6 believe it was in the minutes from the meetings that
7 we did point out that the PRAs had not been QV&Ved
8 except --

9 CHAIR STETKAR: No. I believe it's in the
10 paper itself.

11 MR. DUBE: In the paper itself?

12 CHAIR STETKAR: Yes, yes.

13 MR. DUBE: Okay.

14 CHAIR STETKAR: Yes. They just weren't
15 called --

16 MR. DUBE: I'll pull that out.

17 CHAIR STETKAR: -- preliminary models or
18 something like that.

19 MR. DUBE: Right, right. Okay. So,
20 moving on to MSPI, these case studies probably, much
21 unlike the others, actually showed that the MSPI is
22 really not adequate. And it wouldn't be effective in
23 determining an appropriate regulatory response for
24 active new reactor designs and that it wouldn't be
25 meaningful at all or possibly even possible for

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1 passive systems and passive designs. We do have
2 numerous case studies that demonstrate it as
3 shortfalls.

4 CHAIR STETKAR: Is that mostly because of
5 the higher degree of redundancy in the active system
6 designs that don't exist? I mean, the current index
7 was based on essentially operating reactors with two
8 trains of equipment, right?

9 MR. DUBE: Right. My uneducated answer
10 would be that sounds right to me, but I would --

11 CHAIR STETKAR: That was the sense.

12 MR. DUBE: The real reason for the passive
13 is, I mean, when you have --

14 CHAIR STETKAR: No, no. The active stuff.
15 I understand the passive.

16 MR. DUBE: Yes because you have so many
17 more trains in the active systems.

18 CHAIR STETKAR: Yes. Okay. So it's just
19 that the index didn't anticipate more than two --

20 MR. DUBE: Yes. I mean, I was one of the
21 authors of the current approach in the MSPI, quite
22 frankly. And we went to an unbelievable pilot project
23 with 20 plants. And we did benchmarks. We did Monte
24 Carlo simulations of projecting years into the future.
25 And we instituted a backstop. And these things were

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1 fine-tuned in some ways against the current risk --
2 risk profiles of the current fleet with core damage
3 frequencies upper 10^{-6} to 10^{-4} . And, you know, we
4 didn't look at the 10^{-8} and 10^{-7} core damage
5 frequencies.

6 And the number of failures to reach the
7 threshold of white is inversely related, inversely
8 proportional almost to the core damage frequencies.
9 So in round numbers, if it's typical operating plant
10 is three failures to white, that's a reasonable thing.
11 A new reactor might be 30 to 300 failures to white.
12 Well, that one before you get to 30 failures is a --

13 CHAIR STETKAR: I was just curious. My
14 intuition was it had to do with a degree of
15 redundancy.

16 MR. DUBE: Performance issue.

17 CHAIR STETKAR: Okay.

18 MR. FRAHM: Okay? So we did note that the
19 existing performance limit or backstop could
20 potentially be further leveraged for the active new
21 designs, but we really don't think that is going to
22 get us where we need to be either.

23 We did conclude that alternate PIs in the
24 mitigating systems cornerstone could be developed. If
25 you remember from the earlier chart, we have PIs and

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1 inspection findings. So we could come up with
2 alternate PIs and mitigating systems and additional
3 inspection to compensate for the lack of insights that
4 we have currently gained through the MSPI where we
5 meet the goals of the mitigating system --

6 MEMBER SKILLMAN: Why wouldn't the
7 treasure chest of information that would guide this
8 come out of your maintenance rule components? I mean,
9 where you're tracking your key components, you
10 mentioned the five for your MSPI. Your maintenance
11 rule ought to push out in the AI your nonconformances.
12 And those ought to come up just like a radar blip.
13 And so your idea that it would take 3 to 30 or 300 in
14 order to cross this threshold, it would seem that
15 there's an abundance of information that comes out a
16 whole lot sooner.

17 MR. DUBE: Yes, you are right. Long
18 before you reach an MSPI threshold, you will reach
19 some other action level in online risk monitoring or
20 containment group, yes.

21 CHAIR STETKAR: But that is simply
22 implemented under the plant-specific Corrective Action
23 Program, right?

24 MR. DUBE: Yes.

25 CHAIR STETKAR: It doesn't necessarily --

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1 MR. DUBE: Right.

2 CHAIR STETKAR: -- reach the staff
3 attention unless you do an audit or something or you
4 trip over the index.

5 MEMBER SKILLMAN: Maybe the staff ought to
6 be looking at something more than just this.

7 (Laughter.)

8 MR. DUBE: Yes. That is on the list.
9 That is exactly right. That is what you will see in
10 the recommendations.

11 MEMBER SKILLMAN: Thank you.

12 MR. FRAHM: And isn't the safety system
13 functional failure PI -- would that possibly catch --

14 CHAIR STETKAR: Well, that would again
15 have to have multiple -- it's not going to catch your
16 25 failures of an individual diesel, right, because
17 that doesn't take up a whole bunch --

18 MS. FRANOVICH: Yes. The SSSF PI really
19 today only has a green to white threshold. They can
20 have 100 failures of an SSSF and not trip a yellow
21 threshold.

22 But, back to the maintenance rule, that
23 would be an input through the inspection program. And
24 it's been my experience that maintenance rule
25 inspection findings are never more than green. And so

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1 if you have a lot of unavailability or excessive
2 failures of risk-significant components, that input to
3 the action matrix will not generate a regulatory
4 response given that significant lack of availability
5 or reliability.

6 So we might be able to look at maintenance
7 rule for insights for how we can better inform the
8 action matrix with that information. But that will be
9 something the staff will have to work with industry to
10 explore as an alternate to MSPI for new reactors.

11 Does that make sense?

12 MEMBER SKILLMAN: Yes, it does. Thank
13 you. I understand the words. What I'm really
14 thinking about is in these new reactor designs,
15 particularly where there is so much equipment. The
16 CDF is so low that it can be the sense of where
17 everything is broken. I'm not worried about it.

18 MS. FRANOVICH: Right, right.

19 MEMBER SKILLMAN: Whereas, if the bat came
20 out at the second A1 component, an individual could
21 say, "Hey, we had better pay attention."

22 Now, I think in the industry's defense,
23 they are already doing that. The better-run plants,
24 the better managements understand anything in A1 is an
25 immediate attention item.

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1 But if the real issue here is to raise the
2 threshold or raise the bar in terms of safety, then a
3 thicker magnifying glass and what is popping out of
4 maintenance rule does it for the industry. And it
5 does it for the NRC. At least that is this man's
6 opinion.

7 MS. FRANOVICH: I understand.

8 MEMBER SKILLMAN: Okay. Thank you.

9 MS. FRANOVICH: Thank you.

10 MEMBER SKILLMAN: Thank you.

11 MR. FRAHM: Okay. As I said, there were
12 several examples in MSPI that demonstrated the
13 shortfall in providing any insights, really, into
14 plant performance. The two examples that we put on
15 this slide are that it would take greater than 25
16 emergency diesel generator start failures or greater
17 than 25 run failures for the EPR to exceed the
18 green-white threshold. And then it would take 12
19 failures to reach that performance limit or backstop
20 that exists in MSPI.

21 And in the second example for an APWR, it
22 would take greater than 14 turbine-driven emergency
23 feed pump failures or greater than 25 motor-driven
24 pump failures to exceed the green-white threshold.
25 And, again, it would take at least six failures to

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1 reach the performance limit using the existing MSPI
2 backstop.

3 So, for a little perspective, the last
4 bullet, just off the top of our heads, we would say
5 for current operating reactors, about two to five of
6 these failures would typically result in a white
7 indicator and trigger a regulatory response for the
8 existing fleet.

9 So that's --

10 MEMBER BLEY: Maybe I'd better wait until
11 you get to your conclusion.

12 MR. DUBE: There is no conclusion here.

13 MEMBER RAY: Okay.

14 MR. FRAHM: We will talk about those later
15 today when we talk about the paper.

16 MEMBER BLEY: The smaller number doesn't
17 seem to get at the issue. You talk in some of your
18 options of needing inspections for the passive
19 functions. What it seems to me one needs to think
20 hard about is what would that mean. Anything that
21 would degrade any of the passive protection, which
22 sometimes is a very delicate -- the dynamic balance
23 sometimes that's something like maintaining the film
24 on the outside of the containment.

25 All of these things that are small margins

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1 to the way they're designed, looking for anything that
2 could disrupt, though, it seems to me what we really
3 ought to be thinking about ways to do that to look for
4 those things.

5 I'm not sure saying, well, you need 25
6 failures. Let's look at two or three. I don't think
7 that helps with the issue. I think the issue is more
8 and you've got it there, but it's only in little brief
9 phrases like inspections of the passive process, that
10 sort of thing.

11 MR. FRAHM: Right.

12 MEMBER BLEY: But it's that stuff that
13 could either break down redundancy or could defeat
14 some of these passive features over time, but we need
15 to think real hard about what do you need to look at
16 to see if there is a challenge to those things. This
17 one doesn't help me very much.

18 MEMBER SKILLMAN: I like the way into this
19 because it's a thought that's been resident in my mind
20 for a couple of years. With the part 50 licenses,
21 we're focused on SSCs, structures, systems,
22 components, things that do something for us; whereas,
23 in the fuel plants, they focus on IROFS, items relied
24 on for safety.

25 And it seems to me that with the passive

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1 plants, we're almost in a situation where we need the
2 SFCs plus perhaps a subset of IROFS. Maybe the film
3 is an IROF. And maybe there's a hybrid going forward
4 where we identify those safety features on which we
5 depend, translate those to the components that have as
6 another layer, perhaps as important as the structures,
7 systems, and components, some set of IROFS that are
8 measurable, that are actually defined in the license
9 but somewhat subtly now because of the way the part 50
10 licenses are written or part 52 license or design
11 certifications that will be provided. It seems like
12 maybe as we move ahead, there is room in a new
13 generation of reactors for accommodating IROFS that
14 kind of cut between the analysis, the SFCs, and some
15 thermal hydraulic feature or some physical feature
16 that is just as important as the component that isn't
17 the component, like the film.

18 MR. DUBE: Right, right. I mean, that is
19 why. I mean, we have said that more or less in so
20 many terms that for the passive plants, where you have
21 a system, you have a tank and an explosive valve into
22 the core.

23 The only thing you can monitor is the
24 explosive valve. And you can't test that online. You
25 can only test that sample on --

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1 MEMBER SKILLMAN: Right. You can see if
2 that were to --

3 MR. DUBE: So reliability is meaningless.
4 And I'm not sure even availability because you don't
5 track on -- you don't remove this from service online
6 typically. And, as you pointed out, here it's a
7 degradation of some of the physical parameters. you
8 know, friction coefficient, check valve resistance, so
9 on and so forth, that you are concerned because that
10 is what give the good performance.

11 So the mitigating system performance index
12 paradigm of looking at reliability of diesels and
13 motor-operated valves, air-operated valves, pumps
14 doesn't fit passive plants. And that's why we're
15 saying that's exactly the point we're making, which is
16 we need some other kind of indicator. For the MSPI as
17 formulated, current active plants, it doesn't carry
18 over to the passive plants.

19 MEMBER SKILLMAN: I respect what you say.
20 And I understand it. What I'm suggesting is that
21 maybe we ought to be working with some form of IROFS
22 or translation of the IROFS over into this new
23 environment that we were moving towards.

24 MR. DUBE: Yes. That's the next step.
25 Well, the next step is to get the --

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1 MEMBER SKILLMAN: Yes. Right.

2 MR. DUBE: -- Commission to agree with us.
3 And then the follow-up step will be what do we
4 consider to replace MSPI for new reactors.

5 MEMBER SKILLMAN: Thank you.

6 MEMBER ABDEL-KHALIK: But if you look at
7 this from a very high level, we're doing all of this
8 to protect the health and safety of the public. The
9 new systems are so forgiving that people can screw up
10 without it getting to really trigger anything that
11 would raise your concern.

12 So perhaps what we ought to focus on would
13 be cross-cutting issues, rather than individual
14 triggers. Is there a way that you can do that without
15 looking at these individual MSPI and all of that that
16 would never be triggered?

17 MR. FRAHM: Well, that is already built
18 into the current ROP that we look at cross-cutting
19 issues across all the cornerstones --

20 MEMBER ABDEL-KHALIK: Right.

21 MR. FRAHM: -- and we do the same for the
22 new reactors.

23 MEMBER ABDEL-KHALIK: But those come into
24 play after you trigger the cornerstones.

25 MR. FRAHM: But even a green inspection

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1 finding or anything would actually trigger assigning
2 a cross-cutting aspect that could result in a
3 cross-cutting issue. So you would just need the
4 performance deficiency to get you there. So I think
5 we're covered there. That should be consistent with
6 the current reactors.

7 MEMBER SCHULTZ: Are we coming to a
8 conclusion that matches something like what Dick has
9 proposed or suggested or is it still an open item
10 that's just an item to be considered by the
11 Commission?

12 MR. DUBE: These are just -- you know, the
13 step is Commission agree that we need to do something
14 different in ROP for new reactors. And we are listing
15 these kinds of examples, some potential examples.

16 MEMBER ABDEL-KHALIK: Backstops.

17 MR. DUBE: They tell us "Be specific" or
18 they say, "Okay. Now go off and do it." So, I mean,
19 it's --

20 MR. FRAHM: So that will be in the --

21 MR. DUBE: It's like a two-step process.

22 MR. FRAHM: The next several years of
23 developing the process, et cetera, with interaction
24 with industry and other stakeholders.

25 MEMBER ABDEL-KHALIK: But it would be

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1 heavily dependent on these backstops.

2 MR. DUBE: It could be more dependent,
3 yes, than the current fleet.

4 MR. FRAHM: Certainly more than the
5 current fleet. In fact, we would -- well, I am kind
6 of jumping ahead to our conclusions and
7 recommendations, but we would envision that we would
8 incorporate these deterministic backstops into our
9 existing guidance and that existing guidance applies
10 to the current fleet as well as the new reactors.

11 But we wouldn't expect the current fleet
12 to reach the deterministic backstop. They'll get
13 there by tripping risk thresholds before they ever get
14 there. So we are just looking at a single process,
15 which I think is a little bit different from where we
16 were a year or so ago when we were considering what to
17 do here.

18 That's all I really had for the discussion
19 of the ROP case studies. As I said, we'll talk a
20 little bit later about the options and recommendations
21 in the paper, but you will see that they are pretty
22 closely aligned with the conclusions we had so far
23 here.

24 MEMBER SCHULTZ: I wanted to revisit
25 Said's comment related to the cross-cutting issues

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1 because perhaps there's a rationale, even though the
2 current threshold for consideration is low for the
3 current operating fleet. If you had a fleet of
4 passive reactors, perhaps there's a rationale that
5 says the thresholds should, in fact, be lower.

6 MR. FRAHM: I think I would put that on
7 the things to consider list going forward, but I don't
8 think we have -- you know, we are not there at making
9 decisions at that level.

10 MEMBER SCHULTZ: You know, I understand,
11 but it is just something to keep in mind. If you look
12 at the difficult events --

13 MR. FRAHM: Right.

14 MEMBER SCHULTZ: -- that the industry has
15 experienced, it has been in the cross-cutting issues,
16 the complacency, and self-worth. And there is some
17 tie-in to the passively safe reactor fleet and perhaps
18 a lack of appropriate focus associated with
19 cross-cutting issues.

20 MR. FRAHM: And they may become that much
21 more important in the --

22 MEMBER SCHULTZ: You see them in the
23 threshold as what it is because you are going to have
24 things that happen. You do have things that happen in
25 the fleet that yes, it can be a simple green

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1 inspection finding, but more likely today it is going
2 to be a wide area finding that is going to definitely
3 put an operator in that position.

4 MR. FRAHM: Right.

5 MEMBER SCHULTZ: So it's something to
6 consider.

7 MR. FRAHM: That's a good point. And I
8 wrote it down on my things to consider going to
9 forward. Thanks.

10 MEMBER SCHULTZ: Thank you.

11 CHAIR STETKAR: I would like to ask both
12 of you since before we discuss the actual paper and
13 the kind of details in it -- I wanted to save it until
14 now because the ROP gets sort of the most attention in
15 the paper if I can characterize it that way. And I
16 want to understand the ground rules here or your
17 interpretation of the ground rules from the SRM.

18 Did you look or think about things, rather
19 than -- let me preface this. My impression of many of
20 the sited perhaps deficiencies if you want to call
21 them that in the numerical risk metrics, for example,
22 SDP or other issues, may derive from the fact that the
23 current guidance is based on absolute measures of
24 delta core damage frequency and delta LERF.

25 It says that if I have a delta core damage

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1 of 1.0 times 10⁻⁶, I transition from green to white.
2 1.0 times 10⁻⁴ gets me from yellow to red. Those are
3 absolute measures. They're not relative measures.
4 I've suddenly been asking you questions about what are
5 percentages of changes.

6 And in some of our discussions, we ask you
7 all, how bad would things need to get? And all of
8 your answers have always been, well, if it increased
9 by a factor of two or three or five, that might get
10 our attention, ten percent increase. Those decisions
11 and those discussions are not based on absolute
12 values. You make decisions about importance based on
13 relative measures.

14 The exercise is something you felt pretty
15 comfortable with under 10 CFR 50.69 based on relative
16 metrics. You found those to be reasonably good. We
17 had this discussion about should there be a sliding
18 scale.

19 MR. DUBE: Yes.

20 CHAIR STETKAR: But a relative measure of
21 risk significance, you know, you felt pretty
22 comfortable there. Did you look at under the ROP
23 process, in particular, changing that -- and the
24 extension would be to reg guide 1.174, which is kind
25 of the fundamental basis for all of this -- changing

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1 those absolute metrics on the ordinate to relative
2 changes? And how would that affect some of your
3 conclusions, some of your numerical conclusions, from
4 your tabletop exercise? Instead of saying, "Well, you
5 know, the delta CDF was 2.3 times 10-8," if that were
6 a factor of 2 in the core damage frequency, you might
7 have reached a different conclusion about how useful
8 that numerical risk metric would have been, that
9 relative change. Did you think at all about that?
10 And if not, why not?

11 MEMBER ABDEL-KHALIK: Is that option at
12 all open? The Commission said --

13 CHAIR STETKAR: It is an interpretation of
14 what the SRM --

15 MR. DUBE: The answer is no, it is not.

16 MR. ADER: I am going to disagree. The
17 answer was we thought about it a lot when we were here
18 the first time on the first paper going up asking the
19 Commission for guidance.

20 MR. DUBE: Yes, right.

21 MR. ADER: We talked about we could make
22 it relative. We could make it absolute, some
23 combination of did they want us to go off and develop
24 that framework. They came back and said, "We're
25 reaffirming the existing metrics. Now let's go

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1 tabletop to see if you can definitely using realistic
2 examples tell us that there will be a significant
3 decrease in public health and safety."

4 So in the tabletops, we didn't, but if we
5 had considered them --

6 MR. DUBE: Right.

7 MR. ADER: -- that they do that when we
8 put the first paper up, then that would have been an
9 option we might have pursued if we had gotten a
10 different answer. So this one we felt more
11 constrained with reaffirming 1.174 guidelines,
12 tabletop -- we have gotten a lot of value out of the
13 tabletops, too. So we did accomplish a lot of our
14 objective.

15 CHAIR STETKAR: I guess I hear you,
16 Charlie, but this morning when I was discussing GEH's
17 use of different relative measures, you went to an
18 appendix in 1.174 and said, "Well, we will accept the
19 sliding scale on those measures because sort of the
20 spirit of that appendix is that we could use different
21 scales as a function of core damage frequencies."

22 MR. ADER: I almost interjected there
23 because the paper if you remember the discussion we
24 had is we had a 10-4. We had the 1.174 metrics for
25 the existing processes. Everything tends to point

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1 back to reg guide 1.174: 10-4 CDF, 10-5 LERF.

2 For new reactors, we had been evaluating
3 things against a 10-4 CDF. And there was this 10-6
4 LRF undefined that we had been using to judge the
5 enhanced margins to safety, enhanced severe accident
6 performance.

7 So we had this quandary. And that's why
8 we went to the Commission the first time to say, "We
9 have some disconnect here." We did not have the 50.69
10 relative metrics, the Fussell-Vesely is part of that
11 discussion --

12 CHAIR STETKAR: Right.

13 MR. ADER: -- because this was really what
14 is the level of safety, not what is the relative
15 importance of equipment at some lower level.

16 CHAIR STETKAR: Right.

17 MR. ADER: That was --

18 CHAIR STETKAR: And I understand that part
19 of the discussion.

20 MR. ADER: -- the exercise.

21 CHAIR STETKAR: We're talking here at a
22 different level in terms of a staff set of
23 recommendations for Commission consideration that in
24 many cases, at least as I read the paper -- and we'll
25 talk about the paper -- says, "Well, numerical

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1 quantitative risk information is of limited use for
2 new reactors because if we strictly apply the numbers
3 that are in reg guide 1.174 and in the guidance for
4 the ROP, we don't have enough fidelity to make the
5 types of decisions that we want to make that we feel
6 are necessary."

7 And my question is, well, I ran out a
8 bunch of examples. And transitioning from an absolute
9 change in core damage frequency as a measure of
10 fidelity to a relative measure of change as a measure
11 of risk significance might very well get you through
12 that nature of the metrics don't give you enough
13 fidelity. The quantitative metrics don't.

14 Now, determining what those relative --
15 you know, do you get interest of a factor of red?
16 When core damage frequency increases by a factor of
17 100 or 50 or 30, that's something that would need to
18 be worked out. But it's sort of a different framework
19 of thinking about what is risk significance. Is it an
20 absolute change or is it a relative change from the
21 standpoint? It could also preserve this notion of
22 greater margin for reduced absolute levels of risk
23 because you can have a sliding scale.

24 You know, someone whose baseline core
25 damage frequency right now is 10^{-4} . If you double it,

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1 you're going to get into the red regime. Well, fine.
2 You might decide that you could allow the baseline
3 core damage frequency for a 10-8 plant to increase by
4 a factor of 100. So that gives you greater
5 flexibility. However, it would require kind of
6 changing the framework of 1.174 to measure risk
7 significance always on a relative basis to a baseline
8 risk.

9 That isn't quite the same as 10-6 LERF or
10 10-4 as linked to the quantitative safety goals or
11 necessarily even the basic framework of 1.174 because
12 perturbing --

13 MR. ADER: From a licensing side -- and
14 Don can disagree with me this time. I think from a
15 licensing side in the tabletops, we felt there were
16 enough controls in the process for the new plants,
17 some of them -- tier 1 stuff is not going to be
18 changed without tier 2*. Going through what's
19 realistic, what was viewed as -- we could come up with
20 scenarios that would be viewed as unrealistic.

21 CHAIR STETKAR: Sure.

22 MR. ADER: And the SRMs in the discussion
23 --

24 CHAIR STETKAR: Yes.

25 MR. ADER: -- be realistic and be

1 definitive that you can show us that there will be a
2 significant decrease in enhanced safety. We didn't
3 feel we could pass that test. There are enough
4 controls there we think that give us assurance that
5 there won't be significant decreases.

6 CHAIR STETKAR: I think from a licensing
7 perspective, I certainly understand that. However, in
8 particular, for the ROP, now you're transitioning in
9 terms of using these metrics to inform agency
10 decisions regarding levels of inspection transitions
11 to enhanced inspection. And to a lesser extent, you
12 know, I will bring in populating things like the RTNSS
13 list and the DRAP list, which aren't necessarily a
14 strictly pass/fail safety, licensing issue, but they
15 do have effects going forward in terms of how you
16 treat equipment.

17 MR. ADER: Yes. We have identified some
18 issues in implementation of some of these for new
19 reactors and some things, like RTNSS, that may not be
20 in the guidance for current initiatives that we need
21 to figure out where that fits.

22 CHAIR STETKAR: Yes.

23 MR. ADER: Tabletops have informed us of
24 some of the other issues we need to deal with going
25 forward. At some level, you will have a PRA that is

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1 updated.

2 CHAIR STETKAR: Yes.

3 MR. ADER: So if they make significant
4 design changes over time, you would expect to see that
5 PRA -- for new plants, its regulation, you would
6 expect to see changes there. If there's a lot of
7 unavailability, they would have to factor that. It's
8 a lagging indicator.

9 CHAIR STETKAR: Sure.

10 MR. ADER: It does provide a little bit
11 more of a longer-term backstop. There will be a
12 reasonable way of measuring some of the impacts of
13 some of this stuff, which gave me a little bit of a
14 warmer feeling.

15 CHAIR STETKAR: It is. There are some of
16 those, but it kept hitting me here, especially because
17 I think some of the words in the paper -- that's why
18 I kind of wanted to bring it up before we get into the
19 paper discussion -- that the paper seems to say,
20 "Well, we don't have confidence in quantitative risk
21 measures, in particular." Again, the ROP kind of
22 stands out in my view here -- I might be wrong -- as
23 the issue of most contention.

24 As the quantitative risk measure is
25 providing adequate -- and I'll call it fidelity, not

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1 enough information for us to make adequate decisions.
2 And, therefore, we need to fundamentally rethink
3 certain elements of the reactor oversight process to
4 insert more deterministic backstops, different -- I
5 don't want to -- different indices, different ways of
6 thinking about things to address these deficiencies,
7 if you will, in the quantitative metrics.

8 I'm not arguing. And I'm not saying that
9 those might not be necessary for things that Dennis
10 has mentioned, you know, barrier to performance or
11 some of the more really difficult, thorny issues of
12 purely passive safety functions.

13 However, there may be ways to change the
14 nature of the way those metrics are calculated and
15 treated to improve the fidelity in the quantitative
16 measures that might alleviate some of the concerns
17 about, gee, it didn't address this. So we need to
18 really think about this issue in the sense of what
19 type of deterministic backstop or what other types of
20 guidance do we need for reactor oversight or some
21 other kind of decisions going forward.

22 MEMBER ABDEL-KHALIK: I guess they are
23 taking this approach perhaps based on an
24 interpretation of the wording.

25 CHAIR STETKAR: I think it is. I think if

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1 you go back to your reg guide 1.174 slides, it sounds
2 like a little interpretation that the staff said the
3 Commission wanted to retained precisely those numbers.

4 MEMBER ABDEL-KHALIK: Right. I mean, if
5 I were to just read this, "Continue existing
6 risk-informed framework pending a series of tabletop
7 exercises that test existing guidance," does that mean
8 go test this, come back, we may change our mind and
9 let you use a different framework or use a relative
10 risk metric, rather than an absolute risk metric
11 because you are interrupting this as, okay, we are
12 going to stick with what we have and since it didn't
13 work quite as well as we expected based on these
14 tabletops, we are going to create these deterministic
15 backstops. The Commission may be totally open to the
16 idea of using a different approach.

17 CHAIR STETKAR: We can't speculate on
18 that. It's not job to --

19 MR. DUBE: Charlie and I sat before the
20 Commission on October 14, 2010. I remember very well.
21 We didn't convince them of anything whatsoever,
22 despite white papers and the Commission paper and so
23 forth. And, you know, it came back pretty firm, you
24 know, did not change the safety goals, safety
25 performance expectations, goals, associated values,

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1 key principles, and quantitative metrics. So, I mean,
2 we were pretty faithful to that.

3 We did do one exercise --

4 MEMBER ABDEL-KHALIK: Because they didn't
5 have the benefit of these reports.

6 MEMBER SHACK: I suppose that's what we're
7 suggesting, that there's another option, one option to
8 fix the --

9 CHAIR STETKAR: I mean, the question is,
10 could there be another option in your mix that
11 elaborates on the use -- you know, given the
12 experience from the tabletops, I'm aware --

13 MR. ADER: We did -- Don had written a
14 white paper which was sent up, which I think you had
15 the benefit of one of the other ones, that went
16 through similar types of examples and showed the types
17 of changes that could be seen with the different risk
18 --

19 MR. DUBE: Yes. We had an MDA .3 and an
20 MSPI and a --

21 MR. ADER: So some of that information was
22 there. Our interpretation of that was also -- my --
23 I'll speak for myself -- was flavored by reading the
24 vote sheets, reading the various versions of the SRM
25 that was being crafted. I'll say cobbled together

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1 because I'm sure they don't fit crafted. The vote is
2 just go option 1.

3 MR. DUBE: Yes.

4 MR. ADER: Some do option 2. So it was
5 not option 3 to 2 someplace. You know, I'm saying the
6 way we approach the tabletops and the interpretation
7 from my point of view was all of this kind of taken
8 together, what we saw, where they were going.

9 CHAIR STETKAR: Okay. I mean, none of us
10 can -- you had the benefit of having much more
11 discussion certainly than we have with the Commission
12 and perhaps additional insights.

13 The discussion, many of the words that you
14 can read. You know, I understand maintaining the
15 safety goals. I understand maintaining -- if you use
16 the words "risk metric" as core damage frequency and
17 large early release frequency for the moment, changing
18 the way you measure changes, significance, doesn't
19 affect that.

20 I'm not saying "Change it to 'fatalities'"
21 or anything like that. Maintaining the notion of
22 current safety margins versus safety margins, you
23 know, increased safety margins for new reactors but
24 still allowing flexibility doesn't say how you do
25 that.

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1 MS. FRANOVICH: Yes. So if I could repeat
2 back what I think I've heard for the last hour or so,
3 it's that there may be a fourth option on the table.
4 And it's not about changing the risk metrics that
5 we're using. It's about using those risk metrics in
6 different ways to look at relative decreases in safety
7 as a function of performance.

8 CHAIR STETKAR: And I think you have
9 characterized it very well. And I would call it a
10 different way of quantitatively measuring risk
11 significance, --

12 MS. FRANOVICH: Yes.

13 CHAIR STETKAR: -- not on an absolute
14 value but a relative value.

15 MS. FRANOVICH: Well, we don't go all the
16 way back to deterministic. We still use some
17 qualitative methods that yield more understandable,
18 predictable, transparent outcomes that have a nexus to
19 risk.

20 CHAIR STETKAR: You may still need --
21 sure, this notion of preservation barriers and perhaps
22 special considerations for truly passive functions may
23 need some attention in reactor oversight process, for
24 example. But there may be some usefulness. And I
25 don't know in terms of the time you have available of

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1 at least examining the results of some of the
2 tabletops and seeing how your conclusions about the
3 usefulness of the numerical metrics might change.

4 As I said, I ran a couple of examples.
5 And I could get a lot more into the white and yellow
6 areas, where you were saying they were concerned
7 because they were uniformly green. Using kind of an
8 arbitrary scale, I'm not going to propose a scale
9 here. Obviously that is not what we do, a percentage
10 change.

11 MS. FRANOVICH: Right, right. And so I
12 think that is a concept that we really did not
13 consider that I think could still fit within what the
14 Commission established as its expectations. And we
15 can go back and consider another option, the fourth
16 option, if you will, that really kind of applies that
17 concept. I think it's something we can definitely
18 work with.

19 MEMBER RAY: What is the motive, John?

20 CHAIR STETKAR: Well, the motive in --
21 other than, you know, I am a champion of risk
22 assessment, the motive is to reinforce. If you go
23 back, some of the basic principles -- and I'll come
24 back. I'll come back to ROP because I see this is the
25 area.

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1 The basic principles are maintaining a
2 consistent use of -- you just passed it -- that third
3 bullet there, "Risk inform a process and risk
4 information in a quantitative sense," adds input to
5 that process consistently, regardless of the plant
6 designs. We use it very effectively today for the
7 current operating fleet. We all understand how to do
8 that. And, regardless of who divined why 10-4, 10-5,
9 10-6 ought to be those thresholds, it works okay for
10 the current operating fleet.

11 The sense from the current paper is that,
12 again, in the reactor oversight process that it
13 doesn't work so well there. And so my motivation is
14 to say, can we think about how those metrics are
15 calculated to maintain sort of that same level of
16 confidence in the quantitative risk input, recognizing
17 that for some of the new reactor issues, you may still
18 need --

19 MEMBER RAY: There is always a tension
20 between why should I invest in one of these exotic
21 plants -- and having gone through the AP1000, I'll
22 call it exotic. I think I can do that. Why should I
23 do that if my life isn't going to be made any easier
24 as a result?

25 CHAIR STETKAR: Oh, I want your life to be

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1 made easier.

2 MEMBER RAY: Well, I'm wondering. That's
3 why I'm asking the question.

4 CHAIR STETKAR: I want your life to be
5 made easier. And I want the reactor oversight process
6 to maintain its objectivity and its quantitative
7 nature. And I'm not saying that if you have a --
8 let's take a current operating plant with a 10-4 core
9 damage frequency. If it has a change that increases
10 core damage by 10-6, it transitions from green to
11 white. That's a one percent change. I'm not saying
12 that you transition from green to white with a one
13 percent change for your reactor. You might not
14 transition from green to white until you had many,
15 many percent change.

16 MEMBER RAY: So you get the benefit.
17 We've had this discussion before. I just wanted to
18 hear you say that you acknowledge what you just now
19 did, which is you had to take away --

20 CHAIR STETKAR: No, no, no.

21 MEMBER RAY: -- the advantages that would
22 lead me to make this kind of a commitment in the first
23 place.

24 MEMBER SHACK: But there is a tension
25 between that and the --

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1 MEMBER RAY: Of course.

2 MEMBER SHACK: -- unless you are going to
3 maintain the enhanced safety. While they are going to
4 maintain the enhanced safety by applying these sort of
5 deterministic things -- and I guess we could argue we
6 could do it much more directly by deciding just how
7 much enhanced safety we wanted to maintain and
8 building that into the process.

9 MEMBER BLEY: Let me try something that is
10 bothering me a little bit. I mean, there are a lot of
11 places in today's whole day's discussion where I'm
12 pretty well aligned with what John said, but the thing
13 that bothers me a little bit here is if we are
14 thinking of this to address the issues where we have
15 extensive redundancy -- and losing two or three things
16 really doesn't change the calculation of overall risk
17 much, but you could see it a little bit -- I think
18 what we're doing in this case by suggesting the
19 relative risk, I think, is actually trying to using
20 that relative risk as a surrogate for something else.
21 And the something else is -- maybe there's a better
22 way to deal with this something else.

23 Now, if we have lots of redundancy, we
24 really don't care if we lose a couple of things. It
25 really doesn't change the overall very much. But if

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1 those things that we have lost are symptoms of
2 something that would create dependency across all of
3 these, symptoms of a potential common cause failure,
4 you really want to get them flagged.

5 Now, one way to flag them is to use a
6 small change as a surrogate and begin, but the other
7 way is to somehow -- we've already got a catalog of
8 the things that mostly contribute to common cause of
9 mechanical equipment anyway. For the kind of failures
10 that crop up that would threaten that redundancy have
11 a special evaluation of this could be quantitative,
12 could be qualitative, but at least in this one area
13 where we are looking at extensive redundancy, I think
14 our idea of relative risk is really a stand-in for
15 something that you might do better in another way
16 because we're really worried about losing all of the
17 redundancy or a lot of it.

18 CHAIR STETKAR: And that is essentially --
19 that is the MSPI, is a clear example of that. I think
20 that --

21 MEMBER BLEY: The fact that we have
22 changed, but the overall risk doesn't change much.
23 Really, if that is all that's there, it isn't a big
24 change. It's probably not worth worrying about
25 because a symptom of something that could defeat the

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1 redundancy even greater. You really want to be able
2 to flag that.

3 CHAIR STETKAR: Yes.

4 MEMBER BLEY: I don't know if this is the
5 best way to flag it or not. It's a way.

6 CHAIR STETKAR: I think it's a way that it
7 doesn't completely resolve the problem. It is a way
8 I think that resolves issues related to
9 single-component importance and maintains kind of a
10 consistent treatment across, you know, kind of a broad
11 variety of plant designs or even plant-specific
12 issues. It doesn't fully address the notion of the
13 thing I'll call common cause failure. On the other
14 hand --

15 MEMBER BLEY: My worry is that it wouldn't
16 put the focus of the inspection on the right thing if
17 it isn't couched in the right way.

18 CHAIR STETKAR: On the other hand -- well,
19 the good news is you're going to have two things that
20 happen when you start to think about common cause
21 failures today.

22 MEMBER BLEY: Sure do. And if you only
23 have two, then it's real easy to --

24 MEMBER ABDEL-KHALIK: Your argument about
25 perhaps the lack of utility of the relative risk

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1 measure implies that there is a cliff-edge somehow.

2 MEMBER BLEY: It implies there is an
3 underlying cause that could -- I wouldn't call it a
4 cliff edge.

5 MEMBER ABDEL-KHALIK: But it would imply
6 that --

7 MEMBER BLEY: It is sort of like one.

8 MEMBER ABDEL-KHALIK: -- a gradual change
9 in risk --

10 MEMBER BLEY: If they're not focused on
11 what is going on underneath in a much shorter time
12 than would expect, we might see --

13 MEMBER SCHULTZ: I don't think the
14 relative approach meets the expectations that were set
15 out in the SRM by the Commission. The SRM is saying
16 what is existent today is okay and what advantages we
17 have from the new plant design, we want to be sure we
18 license a plant that's got better performance and
19 better designs. It's going to have more margin than
20 current safety limits.

21 We want to come up with a system that
22 maintains that. But we will give the operator of the
23 facility the allowance to have operational flexibility
24 within that. That's what Harold was getting to.

25 And so we don't want to set up a system

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1 that takes that away at the same time the plant was
2 licensed to have additional safety margin. And so the
3 system needs to assure that that safety margin is not
4 eroded on a design basis.

5 MEMBER SIEBER: That's the key.

6 MEMBER SCHULTZ: So I don't know that the
7 relative approach captures that exactly.

8 CHAIR STETKAR: Well, I mean, we can -- I
9 tend to think it does.

10 MEMBER SCHULTZ: I could tell.

11 (Laughter.)

12 CHAIR STETKAR: And obviously the good
13 thing about Subcommittee meetings is we are all
14 individuals in subcommittee, but this is certainly not
15 ACRS. And you have the flexibility to have these
16 kinds of discussions in the subcommittee meetings.

17 I don't think that this sort of relative
18 measure of risk importance, risk significance solves
19 all the problems. I do think -- and I would need to
20 be convinced otherwise -- that it does preserve a
21 consistent way to factor in quantitative measures of
22 changes in the risk into the regulatory process,
23 regardless of the issues. Again I'll bring up all of
24 B because it's the most evident. And both maintain
25 the desired absolute improved level of safety while

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1 providing increased flexibility for the owner-operator
2 in the sense that they are not burdened with excessive
3 frequency of entering white and yellow findings
4 because this relative -- it's a scale.

5 You don't say one percent change is the
6 same for everybody. One percent change might trigger
7 a white finding for a current operating plant, but you
8 might not trigger a white finding for a 10-8 person
9 until you get a factor of 10 increase. And that will
10 take an awful lot. And, in fact, it probably would
11 take some common cause failures to get me that big,
12 which is a little bit of why it might be a partial
13 surrogate for the concerns about common cause
14 failures. If you got two out of the four of your
15 things fail, you might see a factor of ten increase.
16 And you might then look at those two to see, ah, is
17 there some sort of common cause issue going on here
18 that could have affected all four?

19 MEMBER SCHULTZ: But you have to design
20 that very carefully.

21 CHAIR STETKAR: It has to be designed. I
22 didn't say it was easy.

23 MEMBER SCHULTZ: It has to take into
24 account, as we have discussed today, the quality of
25 the risk assessment methodology and all of the pieces

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1 that fit into that.

2 MEMBER SHACK: That's been today --

3 CHAIR STETKAR: That's right. You know,
4 the agency is making regulatory decisions based on the
5 quality of in some cases only the SPAR models. And I
6 think it's more often a comparison between a SPAR
7 model and an individual licensee's calculations. So
8 that's not an issue that is unique to new reactors.

9 MEMBER SCHULTZ: That is correct.

10 MR. ADER: For what it is worth, I had the
11 original paper with me. And it had Don's white paper
12 attached to it, which had some options which were
13 independent of the Commission paper. One of the
14 options -- and this was in licensing context -- was
15 convert to relative risk changes in 1.174. So the
16 first go-around consisted of that, and it was raised.
17 I mean, it was part of the package that went to the
18 Commission.

19 CHAIR STETKAR: Yes. I think that --

20 MR. ADER: But my earlier answer, I was
21 focusing more on the licensing side of 1.174 change.

22 CHAIR STETKAR: Yes. I think at this
23 stage, all I am proposing is, does this concept merit
24 enough attention to be added to the paper as an option
25 for consideration by the Commission with some

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1 supporting information?

2 You know, the Commission may very well
3 come back and say, "Hey, we told you that we didn't
4 want to consider this. And, yes, pressed us. We
5 understand absolutely what this means." Fine.

6 MS. FRANOVICH: I think the biggest
7 challenge for the staff at this juncture would be
8 putting enough meat on the bones for the Commission to
9 really have a good understanding of what exactly we
10 would be proposing. We'll have to go back and see if
11 we have enough information from the tabletops to put
12 together a reasoned methodology that would get us to
13 a different decision standard using risk insights, if
14 you will.

15 CHAIR STETKAR: Yes. I think, again, if
16 this is an option in a Commission paper, you certainly
17 can't solve the notion of exactly what are those
18 trigger points.

19 MS. FRANOVICH: Right.

20 CHAIR STETKAR: And you ought not to do
21 that.

22 MS. FRANOVICH: Right.

23 CHAIR STETKAR: It's just a question of
24 would a different way of measuring that risk
25 significance --

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1 MS. FRANOVICH: Right.

2 CHAIR STETKAR: -- on a relative basis
3 provide you a vehicle that might give you more
4 confidence in those numerical measures down where you
5 need increased fidelity and then leave it. You know,
6 obviously it's at the same point right now.

7 If the Commission said, "Well, yea,
8 verily, go ahead and come up with new deterministic
9 backstops and things like that," you are not proposing
10 what those backstops are. You just signal forth you
11 need to think pretty hard about what they might be.

12 MS. FRANOVICH: True. We've been able to
13 say, you know, we're thinking they may be around
14 barriers or common cause failure, that kind of thing.
15 But you may be right. Just conceptually here's
16 another option that the staff has formulated with
17 input from the ACRS. And, you know, we would still be
18 able to achieve the ROP fundamental tenets of being
19 risk-informed, predictable, understandable, and
20 objective. So if we put those parameters around it,
21 it would give I think the Commission a better
22 understanding of what at least we would be trying to
23 achieve.

24 Biff?

25 CHAIR STETKAR: Biff, I was ignoring you,

1 but I just thought you had something to say.

2 MR. BRADLEY: I would like to raise an
3 administrative point. If the staff intends to add
4 that option to the paper, I would like to request that
5 we go back through the public interactions because the
6 interactions we have had so far have not included
7 that. We would certainly have comments on that
8 proposed approach.

9 MS. FRANOVICH: Another potential
10 impediment with the time that we have. So we will
11 have to see what we can achieve.

12 MR. BRADLEY: All right.

13 CHAIR STETKAR: And I appreciate that
14 process, by the way. It's important.

15 MR. FRAHM: And I would anticipate that
16 there would be others, too, that say that would be
17 outside of what the SRM directed the staff to do --

18 CHAIR STETKAR: Fine.

19 MR. FRAHM: -- just a consideration,
20 including some commissioners, you know, in reading the
21 vote sheets and whatnot. I mean, they were very clear
22 in many ways that the risk is what it is. And I don't
23 think this is part of the --

24 CHAIR STETKAR: Is there a full Committee
25 meeting scheduled? There is a full Committee meeting

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1 scheduled on this in --

2 MR. FRAHM: April.

3 CHAIR STETKAR: -- April. So it's soon.

4 We needed to do that because they certainly want a
5 letter. And that gives us enough time to get a letter
6 in a timely fashion for them.

7 I just wanted to float that. We do need
8 to go obviously through the paper. Is there any more
9 discussion on my ranting?

10 (No response.)

11 CHAIR STETKAR: Thank you. Let's take a
12 break until 3:00 o'clock. We're recessed.

13 (Whereupon, the foregoing matter went off
14 the record at 2:44 p.m. and went back on the record at
15 3:03 p.m.)

16 CHAIR STETKAR: We're back in session.
17 Let's hear about the paper unless there's anything
18 more to discuss about the -- by the way, just for the
19 record, Bill reminded me that for clarification, when
20 I talk about relative measures, there's -- what I am
21 staring at here and what is inappropriate to kind of
22 discuss in detail, the relative measure's on a log-log
23 scale.

24 So they provide a -- it's not a uniform
25 one percent change or 20 percent change or 50 percent

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1 change across the board. They're consistent
2 percentage changes on a log-log scale as a function of
3 CDF or LERF or whatever measure. So if there's any
4 concern about the motion of keeping the same one
5 percent change, regardless of what your core damage
6 frequency is, that certainly doesn't satisfy the
7 conditions. And that's not what I am proposing at
8 all, not at all.

9 With that, let's hear about the paper.

10 9. CONCLUSIONS, OPTIONS AND RECOMMENDATIONS TO
11 COMMISSION IN DRAFT PAPER

12 MR. DUBE: Okay. Good. So the major
13 conclusions were from the tabletop exercises for
14 licensing applications, staff did not identify any
15 potentially significant decreases and enhanced safety
16 margins for new reactors, didn't identify a gap in the
17 process, the guiding severe accident features that are
18 not related to ex-vessel severe accident prevention
19 and mitigation.

20 And we've got a recommendation along those
21 lines. And the current risk thresholds are
22 appropriate for ROP. However, the changes to the ROP
23 may be warranted consistent with the integrated
24 risk-informed principles of 1.174.

25 MEMBER ABDEL-KHALIK: That's a mild way of

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1 putting it.

2 MR. FRAHM: It was high-level --

3 MR. DUBE: So on risk-informed in-service
4 inspection, we talked about this, the original
5 tabletop back in September. We found that it's a
6 risk-neutral effect for new active plants and new
7 passive plan, even when we did -- we did do
8 sensitivity studies here where we use more restrictive
9 acceptance criteria didn't change our overall
10 conclusions.

11 There are numerous regulatory and
12 programmatic controls; for example, inspection of a
13 minimum set of weld locations, regardless of risk
14 level. It's a dynamic process ten-year ISI program,
15 incorporates lessons learned and updates to risk
16 ranking. It is also very consistent with part 52
17 requirements for new reactors to upgrade and maintain
18 the PRA.

19 On the risk-informed completion times,
20 time and time again as we did -- well, between us and
21 the industry participants, well over 100 case studies,
22 the risk-informed completion time is limited to a
23 deterministic maximum of 30 days, often called the
24 backstop completion time, from the time the tech spec
25 action was presented.

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1 And voluntary use of the risk-managed tech
2 spec for a configuration which represents a loss of
3 total tech spec safety function or inoperability of
4 all required trains is not permitted. And we saw
5 these again in all of our kinds of exercises that we
6 did.

7 We do mention and we mentioned in the
8 paper we did identify some configurations of equipment
9 outages that would represent, could represent ten
10 years worth of core damage probability.

11 Repeated entry over time could increase
12 core damage frequency by an order of magnitude or
13 more, which could approach the baseline CDF of
14 currently operating plants. But these are extreme
15 stretch cases of configurations that are unlikely or
16 unrealistic, found the additional regulatory and
17 programmatic controls that would limit the aggregated
18 risk increase; for example, under part 52, as we
19 mentioned, under 50.71(h), part 52 plants that are
20 licensed. You know, performance monitoring is
21 required. Periodic PRA maintenance and upgrade are
22 required.

23 I don't have a fourth bullet, but a point
24 that often gets brought up is, even under the current
25 standard tech specs, it can be in these

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1 configurations. And what you find under risk-informed
2 tech specs is a process and programmatic controls in
3 place to limit the risk increase; whereas, in current
4 tech specs, you could have these hypothetical
5 configurations and with lesser degrees of control. So
6 I think the staff feels very comfortable with
7 risk-informed tech spec 4b.

8 So we conclude there are no substantive
9 changes to the methodology. And we get some
10 implementation issues but, as I said, no fundamental
11 change to the methodology.

12 MEMBER SCHULTZ: Don, on that slide, ten
13 years worth of core damage probability. So that's
14 going back to a relative measure there. Are you not?

15 MR. DUBE: The point was, you know, in a
16 hypothetical situation where a lot of equipment out of
17 service -- and these were like in three-train plant
18 difference, two trains out of service. And they find
19 themselves in an unplanned outage of a third train.
20 I mean, those circumstances, even if you're in there
21 for a short period of time, the increase in core
22 damage frequency and the time duration, the integral
23 could give ten years worth of core damage probability.

24 And the point I made was it's extremely
25 unrealistic. And this situation can occur in a

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1 current plant under current tech specs. But that's
2 what that meant. We weren't talking relative here
3 necessarily.

4 CHAIR STETKAR: Don, one brief editorial
5 comment. You may just want to make a note of this.
6 It could be caught in the final version. But in
7 appendix A, where you discuss the issue of 4b, it
8 says, "MHI Application for RITS 4b and the US-APWR
9 Standard Design and Luminant COL Application for
10 Comanche Peak Units 3 and 4."

11 In particular, when we assess, in essence,
12 pilotless efforts with new designs, it's my
13 understanding that the US-APWR-certified design will
14 not have risk-informed tech specs. They are
15 formulating their tech specs with an option for risk
16 information, but the standard design won't have
17 risk-informed tech specs. But they have a framework
18 that allows it. But for the certified design, at
19 least current understanding is they're only going to
20 use the standard tech specs completion time.

21 So it is true. Comanche Peak, at least
22 today, still is saying they are going to risk-inform
23 their tech specs in the CLL. Just, you know, that is
24 a bookkeeping issue.

25 MR. DUBE: Yes.

1 CHAIR STETKAR: It doesn't change at all
2 the technical essence of the discussion or anything
3 like that.

4 MR. ADER: We'll check. The last I was
5 thinking is -- and we try to still have them in.

6 CHAIR STETKAR: The version I have seen
7 says use the standard tech specs or a risk-informed
8 value derived from this other document. They're not
9 going to develop that other document. They're simply
10 providing the shell of the tech specs to allow someone
11 -- it's kind of like the setpoint-change methodology.
12 Use this setpoint or a setpoint derived from a
13 to-be-inserted-later setpoint development document.

14 So I don't believe that MHI is going to be
15 presenting any actual AOTs that are different --

16 MR. ADER: No. They wouldn't.

17 CHAIR STETKAR: -- from the standard
18 design.

19 MR. ADER: And that's where the
20 implementation issues that we have been dealing with,
21 and even coming out of the tabletops, is for a plant
22 that is not yet built and operating without operating
23 experience, you can't get the final quantification.
24 But they want that option. So you have to put it in
25 there that refers to a defined process. So they kind

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1 of do, kind of don't. But they haven't gone all the
2 way.

3 MR. DUBE: Okay. I made a note. On the
4 maintenance rule, 50.65(a)(4), staff found no gaps in
5 the assessment and management of risk. And we'll
6 talk.

7 During the exercise in the tabletop, we
8 actually exercised an online risk management tool, for
9 example, or contracted it. When the PRA approach is
10 combined with other inputs such as the degree of
11 defense-in-depth and plant transient assessment,
12 factors other than PRA were often found more limiting
13 in terms of the risk management action level. So they
14 look at not just the PRA risk values but also what's
15 the impact on defense-in-depth? Is defense-in-depth
16 still maintained? And what about the impact on plant
17 transient situations? If you are working on main
18 steam isolation valves, obviously there is an impact
19 on reactor consistency and what have you. And often
20 those were more limiting than the change in core
21 damage frequency, if you will, based on the existing
22 guidance.

23 And the other thing is -- and the Chairman
24 here will be very happy with this paragraph -- NUMARC
25 93-01, section 11 explicitly acknowledges there is

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1 acknowledged variability in baseline core damage
2 frequency and large early release frequency, blah blah
3 blah, determination of the appropriate quantitative
4 risk management action thresholds are plant-unique
5 activities. This means, for example, that there isn't
6 a one size fits all level for action that -- I hate
7 the word to use "relative" because I can see from the
8 audience -- is that --

9 CHAIR STETKAR: That's okay. He gets a
10 chance to come up after you guys are through.

11 MEMBER SHACK: But there's not a whole lot
12 of guidance to tell you how to pick those.

13 MR. DUBE: Right, correct.

14 MEMBER SHACK: And the suggestions are
15 obviously geared towards current.

16 MR. DUBE: Yes. We do know that some
17 changes may be necessary to the guidance because you
18 get some new SSC, structures, systems, and components,
19 in the new reactor designs. And the staff right now
20 is reviewing the guidance documents to see if some
21 changes might be necessary because of scope issues,
22 but I will just note that these aren't related to what
23 we have been talking about in terms of risk metrics or
24 thresholds or increased enhanced level of safety.
25 They're kind of more administrative in nature, I would

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1 say.

2 On surveillance frequency control
3 programs, staff found no gaps in here. And we have
4 listed some of the summary documents, seven, eight
5 reasons. They are getting core here, some of the
6 basis.

7 Surveillance frequencies that are
8 controlled by other programs are excluded. And so
9 what is covered, equipment covered by in-service
10 testing, for example, major pumps and valves, tend to
11 have some of the highest risk importances, but these
12 are excluded from this particular initiative. In
13 fact, what is left usually are things like, you know,
14 control wide movement or MSPI testing or some
15 radiation detection equipment or something along those
16 lines.

17 So what remains to be implemented under
18 RITS 5b generally are lower risk-important components.
19 So what happens to it usually is not going to impact
20 the baseline risk very much.

21 But more importantly is that fourth
22 bullet. And that is unlike tech spec initiative 4b,
23 5b is much more deterministically oriented, with risk
24 impact only a secondary condition in the criteria for
25 changing surveillance test interval. And I think we

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1 talked about this during the September subcommittee
2 meeting, but basically it's highly dependent on
3 performance monitoring, that any particular change in
4 surveillance frequency usually goes in a phased
5 approach if it's a monthly testing. They may go to
6 maybe two months or three months. And it's a gradual
7 change. At every step they hold, observe, that they
8 identify changes in performance. The IDP, integrated
9 decision-making panel, may decide, you know, let's
10 look at the trends, look at the costs, and may decide
11 to actually go back if an adverse trend is resulting.

12 Some examples, some equipment you want to
13 exercise off frequently because things stick. Seats
14 stick in valves. That's solenoid-operated valves and
15 what have you. And the testing almost has a
16 preventative maintenance function as well as a testing
17 function.

18 So staff found no gaps if applied to new
19 reactors.

20 We talked about 50.69. I won't dwell on
21 that. Staff believes there are no gaps.

22 On 174, we've talked about this all
23 through this morning. So I won't emphasize this.
24 Again the staff found no gaps.

25 We have talked this morning about the

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1 change process. It's called 50.59-like. We found a
2 gap in that. You know, this definition of ex-vessel
3 severe accident and the applicability of the tier 2
4 change process to just ex-vessel severe accidents are
5 not other features that may be there to prevent or
6 mitigate accidents, severe accidents, that are still
7 retained within the reactor vessel seem to be excluded
8 from the process. And the criteria that might be used
9 are more applicable to design basis accident analysis
10 evaluation assessment, not severe accidents.

11 So we do have a recommendation to address
12 this potential gap by ensuring that there are
13 sufficient details on all key severe accident features
14 in tier 1 and including a change process in future
15 design certification rulemaking in section VIII for
16 non-ex-vessel severe accident features similar to
17 section VIII.B.5.c for ex-vessel severe accident
18 features.

19 You know, because we did review those
20 designs that have been certified, we're not proposing
21 any kind of backfit because, actually, something like
22 this is actually a rule. I mean, it's right in the
23 Code of Federal Regulations, part 52. I mean, it
24 actually would require a backfit analysis. We're not
25 proposing to go to that extent because we feel

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1 confident for the current reactors that have been
2 certified that we don't have this gap.

3 CHAIR STETKAR: Don, the way this one is
4 presented, here it says A and B.

5 MR. DUBE: Yes.

6 CHAIR STETKAR: Is A sufficient? I mean,
7 as I understand it, you made your determination --

8 MR. DUBE: Very good. That's a very good
9 point because we had an "or" here before.

10 CHAIR STETKAR: Ah. Okay.

11 MR. DUBE: And the staff discussed it.
12 And management change discussed it. And I know
13 industry will recommend an "or," at least an emphasis
14 on A.

15 The thing is if you speak to those who
16 have been involved with this 52 process since day one,
17 I mean, they will admit that the way they define
18 ex-vessel severe accident in the statement of
19 considerations, they should have used different
20 language. That was all-encompassing. That should
21 have encompassed non-ex-vessel, should have
22 encompassed those five -- remember, those five
23 containment challenges --

24 CHAIR STETKAR: Yes.

25 MR. DUBE: -- should have referred back to

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1 whatever that -- those regulations that describe those
2 five. They should have actually had that.

3 So, in answer to your question, showing
4 that it is in tier 1 is a good stopgap measure, it
5 will address staff's concern, but it is a work-around.
6 And, really, the thing is in our opinion, you know,
7 the rules should be changed. Going forward, the rule
8 should be made right.

9 CHAIR STETKAR: Don?

10 MR. DUBE: There was a lot of -- I mean,
11 excuse me -- a lot of discussion with OGC General
12 Counsel on this particular -- in fact, I mean, 90
13 percent of our comments on the draft Commission paper
14 has been on this very issue. So it's generating a lot
15 of interest.

16 MEMBER SKILLMAN: From your slide 41, I
17 thought that the real thrust of this was, if you will,
18 the sneak path of the work-around on tier 2 for the
19 ex-vessel.

20 MR. DUBE: Right. That's why by ensuring
21 it's in tier 1, tier 1 requires staff to require
22 approval. It makes sure that significance --

23 MEMBER SKILLMAN: What you are doing is
24 lifting them out of tier 2 into tier 1.

25 MR. DUBE: Yes, yes. Any significant

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1 change is going to change tier 1. Right now you will
2 find in tier 1 statements like -- I showed you that
3 example on the reactor vessel injection using
4 firewater for APWR. That's pretty explicit, I mean.

5 MEMBER SKILLMAN: Yes.

6 MR. DUBE: It says there are valves there.
7 There are two valves, manual operation, so on and so
8 forth. You are not allowed the flexibility to change
9 that. But there are some tier 1 statements, like
10 "This feature is used for this," you know, literally
11 ten words or less. And all the rest of the details
12 are in tier 2. And so change tier 2 under a licensee
13 control process. There's a lot of room for a lot of
14 license, if you will --

15 MEMBER SKILLMAN: It seems to me the words
16 are still vague. It would seem to me that --

17 MR. DUBE: What words are vague?

18 MEMBER SKILLMAN: Under A, under alpha, I
19 would think you would want to say ensuring that all
20 details regarding key severe accident features are in
21 tier 1.

22 MR. DUBE: Just that all key severe
23 accident features are in tier 1, including details.

24 MEMBER SKILLMAN: Yes. But what is absent
25 in A at the current time, if you will,

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1 comprehensiveness so that details cannot be varied in
2 tier 2.

3 MEMBER SCHULTZ: That's not how I read it,
4 but if that's what you intended, that's not the words.

5 MR. FRAHM: "Ensuring that all key
6 accident features are included in tier 1" or something
7 like that and take out "the sufficient details."

8 MEMBER SKILLMAN: That would certainly do
9 it for me. It seems that --

10 MR. FRAHM: Do you see the difference?

11 MEMBER SKILLMAN: The details are obscure.

12 MR. DUBE: No, but I only got a 500 on SAT
13 Verbal. So I --

14 (Laughter.)

15 MEMBER SKILLMAN: That's pretty good.
16 That's pretty good.

17 MR. ADER: One of the concerns when you're
18 going back and forth with OGC was are we being
19 inconsistent in the level of detail, what we have done
20 on the ones we have certified?

21 MEMBER SKILLMAN: Right.

22 MR. ADER: We were looking at putting it
23 in tier 1. The subset in tier 1 has been through the
24 three we have certified. So we're still saying keep
25 it in tier 1 with the high-level important stuff

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1 because that would require a real change to change the
2 certification but not that it had a balance. So we
3 don't have to put excruciating details into tier 1 and
4 give it the tier 2 flexibility to change if there was
5 a gap, there was no change process to evaluate it
6 under. So that's why we --

7 CHAIR STETKAR: And this keeps you covered
8 in -- you can still have a fairly high-level
9 description in tier 1 consistent with a lot of the
10 other material in tier 1.

11 MEMBER SKILLMAN: But, still, the real
12 change from the present wording that you have
13 presented in A needs to be the comprehensiveness of A.
14 A has got to cover them all.

15 CHAIR STETKAR: A does say, though, "all
16 key severe accident features." It doesn't say, "all
17 severe ex-vessel severe accident features." So the
18 "all key severe accident features," my interpretation
19 is that comprehensiveness.

20 The level of detail that's in tier 1 for
21 these particular things ought not to be any more
22 detailed than is for any other safety system or
23 function.

24 MEMBER SKILLMAN: Well, let me push a
25 little bit further. If A is written, what is in tier

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1 2?

2 CHAIR STETKAR: The details.

3 MEMBER ABDEL-KHALIK: The rest of the
4 details.

5 MEMBER SKILLMAN: I understand that
6 because I did this for the US-APWR. Where I'm going
7 is on your page 41, you showed a reasonable
8 work-around. And I think what you are trying to do
9 with this particular set of statements is to preclude
10 this from occurring.

11 MEMBER SHACK: No. He is happy that it's
12 there.

13 MEMBER SKILLMAN: Pardon?

14 MEMBER SHACK: He is happy that it's
15 there. The statement that's in tier 1 now is what
16 saves him in the ABWR. And you wouldn't want to --

17 MEMBER SKILLMAN: Right.

18 CHAIR STETKAR: Putting it in tier 1
19 hopefully kicks you out of the first diamond to the
20 right on page 41. Even if it doesn't, still if you
21 make a change to some subtle design detail that you
22 didn't quite capture in tier 1, the tier 2 requirement
23 would kick you out to the right.

24 MR. ADER: I can't think of anything --
25 tier 2 pretends to provide more detail on the feature

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1 of what's in tier 1.

2 MEMBER SKILLMAN: I understand.

3 CHAIR STETKAR: I'm sorry I asked, but I
4 do understand now sort of the basis for "and."

5 MR. DUBE: Okay. You still don't like the
6 words?

7 CHAIR STETKAR: No, no, no, no. I
8 understand the -- I only asked whether or not they
9 were essentially redundant when simply the first would
10 be necessary and sufficient. But I can see given the
11 possibility of fairly limited design information in
12 tier 1, it may not be necessary and sufficient.

13 MR. ADER: What you may have in tier 1 is
14 provides sufficient flow to provide cooling. In tier
15 2, it may say, "Our pump is 450 gpm." You make a
16 design change that takes it to 400. I don't want to
17 have to do a rule change if 400 is also sufficient.

18 CHAIR STETKAR: But you do want to have
19 them do the evaluation.

20 MR. ADER: I do want to have them do the
21 evaluation if that makes sense.

22 MEMBER SKILLMAN: It does. Thank you.

23 MR. DUBE: Good. And on the large release
24 frequency, the LRF operations, have talked about this
25 earlier. So I won't dwell on it, the options.

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1 I acknowledge Steve Schultz's comment on
2 this particular thing, but we are doing something
3 additional. I may not ever use this slide again, but
4 --

5 (Laughter.)

6 MR. DUBE: -- if I do, I made a note.

7 CHAIR STETKAR: You will be before the
8 full Committee.

9 MR. DUBE: Yes. I don't know how much --

10 CHAIR STETKAR: Steve made notes.

11 MR. DUBE: And the recommendation is
12 option 2C, to harmonize risk-informed applications for
13 the new reactors consistent with the risk metrics used
14 by the current operating fleet. So 2C is this with
15 the provision for leaving performance objectives.

16 We did not do our risk-informed
17 initiative, had neither time nor resources. We did
18 focus on every single process that was identified in
19 the Commission SRM. So that we did do. And then we
20 did beyond that.

21 We didn't do in-service testing of pumps
22 and valves. We did not do integrated leak rate
23 testing interval, didn't do whatever 50.46a may have
24 evolved. We didn't do equivalent of NFPA 805, which
25 is risk-informed fire protection, did not do 806.

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1 There was enough to do.

2 Some of the reason was there appeared to
3 be little short-term interest by COL applicants. When
4 I say "short-term," I mean something that we have to
5 worry about here in the next couple of years.

6 Some applicants were actually COL holder
7 now. So maybe down the road they want to go all
8 risk-informed on everything, but we'll leave that to
9 the next generation of reactor analysts, the risk
10 analysts that do these tabletops. We didn't do it.

11 I do note that alternative source term,
12 reg guide 1.183, is implemented at all the new designs
13 with COLAs except ABWR. So that activity has moved
14 forward.

15 And then I'll turn it over now to Ron
16 Frahm.

17 MR. FRAHM: Okay. As we discussed just
18 earlier today, based on the ROP tabletops, we did come
19 up with three options for the Commission to consider.
20 Under all of these options, we tried to meet these
21 three objectives and then some that are pointed out in
22 the paper.

23 And we believe that these are consistent
24 with the SRM direction, and that is to maintain the
25 current risk thresholds for the new reactor designs to

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1 be consistent with reg guide 1.174 and our integrated
2 risk-informed decision-making and to not infringe upon
3 the greater operational flexibility that's afforded
4 the new reactors based on their more robust designs.

5 The first option is basically use as is,
6 don't make any changes under this option. An obvious
7 advantage is that there are no additional resources
8 needed to implement this option, but at the same time,
9 it falls a little short. And we might not always
10 provide for an appropriate regulatory response.

11 MEMBER ABDEL-KHALIK: I would have used
12 the words "may never," instead of "may not always," in
13 reference to that.

14 MR. FRAHM: Well, not always. Well, it's
15 pretty close to it. But we don't want to downplay the
16 feasibility of all the options. We had a flavor. We
17 didn't want to leave --

18 CHAIR STETKAR: They found some things
19 where the existing framework indeed triggered things
20 that they felt were appropriate.

21 MR. FRAHM: We want to provide actual
22 options that are reasonably feasible. Some might be
23 better than others.

24 MEMBER ABDEL-KHALIK: Be careful what you
25 ask for.

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1 MR. FRAHM: Okay. Moving on to option B
2 or second option is to augment the existing processes.
3 You'll notice that --

4 CHAIR STETKAR: Don, hit the button.

5 MR. FRAHM: You'll notice that the
6 implementation here is very similar to the conclusions
7 we have from the tabletops that were presented
8 earlier.

9 Under this option, we would use the
10 existing risk-informed SDP but augment it with
11 deterministic backstops, as we have talked about.
12 Under MD 8.3, we would modify the existing
13 contribution of deterministic criteria or potentially
14 develop new backstops consistent with the SDP. And
15 under MSPI, we would develop an alternative indicator
16 or additional inspection in the mitigating systems
17 cornerstone to compensate for not getting a whole lot
18 of insight out of MSPI. And then we would also have
19 to increase the inspection of passive mitigating
20 systems for the passive designs.

21 An obvious advantage to this option is
22 that it aligns very closely to the conclusions from
23 the tabletops. Another advantage is that these
24 proposed enhancements could be developed using
25 existing resources that are already budgeted and could

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1 take place over the next several months or even years
2 prior to new reactors going into operation and work
3 with external stakeholders and internal stakeholders,
4 for that matter, to develop the specifics of the
5 deterministic backstops.

6 The third option, option C, is to develop
7 deterministic tools and essentially not use the
8 existing risk-informed SDP tools but, instead, develop
9 new tools that are specifically designed for new
10 reactors. They would capture risk insights but using
11 deterministic guidance consistent with the licensing
12 basis and design certification.

13 A disadvantage is that these tools would
14 be less risk-informed than for the current fleet,
15 obviously. And then another disadvantage is that we
16 probably would require additional resources above and
17 beyond what is currently budgeted to research and
18 develop the new guidance documents.

19 CHAIR STETKAR: And, as usual, it seems to
20 fly in the face of Commission policy on risk-informing
21 the regulatory process, but there's that.

22 MR. FRAHM: Right. But it does meet the
23 SRM of maintaining the current risk thresholds because
24 they are still there. Pretty hard to come up with
25 three options.

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1 CHAIR STETKAR: Oh, okay.

2 MR. FRAHM: In case you hadn't guessed,
3 we're going to recommend option B, to augment the
4 existing processes. And prior to doing so, obviously
5 we would obtain Commission approval. And, in fact, at
6 least one year prior to implementation, assuming the
7 Commission directs us to go this way, or one year
8 prior to implementing it, we would go back to the
9 Commission and say, "Here is what we plan to do" and
10 then get their blessing going forward.

11 And, as part of the ROP, we have built in
12 a continuous improvement process. So these
13 enhancements could be refined over the years as we
14 learn lessons and further tweak to get where we need
15 to be.

16 CHAIR STETKAR: I was going to ask you,
17 Ron, rather than running some formal pilot process
18 over a period of time, you would rely on that normal
19 improvement process to sort of work out the details of
20 the rough edges.

21 MR. FRAHM: That was our thinking. The
22 pilot idea I wouldn't discard.

23 CHAIR STETKAR: Okay.

24 MR. FRAHM: Yes.

25 MS. FRANOVICH: That could be a management

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1 decision that --

2 CHAIR STETKAR: Yes. No. I was just
3 curious in terms because I've got the words about --

4 MS. FRANOVICH: We could do it that way.

5 MR. FRAHM: We often run pilots for
6 implementing new things. So that would probably make
7 quite a bit of sense, and I could see that. That's a
8 good point.

9 And, with that, that's the end of the ROP
10 recommendations and options.

11 MR. DUBE: Yes. Well, we ain't got a lot
12 of next steps left. A year ago this was a dozen, but
13 this is the full ACRS 12, finalize the Commission
14 paper. And the paper is due to the Commission early
15 June but actually due to the EDO, the Executive
16 Director for Operations, I believe it is, May 24th.
17 So it's tight. It's very tight.

18 That's it.

19 CHAIR STETKAR: Are there -- any members
20 have any comments or questions for the staff?

21 (No response.)

22 CHAIR STETKAR: If not, thank you. Before
23 we close, I want to make sure NEI has their time --

24 MR. DUBE: Right.

25 CHAIR STETKAR: -- and we get input from

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1 the public if there is any. There's a lot of material
2 to cover. And we may need to have a little bit of
3 close-out discussion about what is appropriate to
4 bring under the full Committee meeting --

5 MR. DUBE: Okay.

6 CHAIR STETKAR: -- because we have got a
7 very limited time slot there.

8 MR. DUBE: Right, right.

9 CHAIR STETKAR: But I want to make sure
10 that we have an opportunity to hear from NEI and
11 anyone else who might want to provide anything. So if
12 we can do that, Biff, do you want to come up?

13 MR. BRADLEY: I saw somebody do some kind
14 of ALT-CTRL-something.

15 CHAIR STETKAR: Ron is adept at this.

16 MR. BRADLEY: Are you ready to go?

17 CHAIR STETKAR: We're ready.

18 MR. BRADLEY: Okay.

19 10. STAKEHOLDER PERSPECTIVES ON
20 RISK-INFORMED REGULATORY FRAMEWORK FOR NEW REACTORS

21 MR. BRADLEY: Thanks for the opportunity
22 to present to the Subcommittee today. I just have a
23 few slides, really. Hopefully it will be far briefer
24 than the 81 slides we just went through.

25 Just sort of my apolitical announcement

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1 here is, you know, we really believe that plants
2 should actually be encouraged to pursue these
3 applications. They have PRA requirements under 50.71
4 to meet endorsed standards and to periodic updating.
5 It's all built directly into the regulations for these
6 plants.

7 So it would be a shame for them not to
8 benefit from those models and use them for these
9 applications. It makes the models better, and it
10 makes the whole objective of having these models much
11 more attractive to the plants.

12 So it probably goes without saying, but
13 sometimes I get the impression from talking to the COL
14 community that it is sort of like a heavy lift to try
15 to implement these. And I really don't think it
16 should be.

17 As I mentioned, there are a lot of things
18 available, both voluntary. One point I want to make
19 is that there are certain mandatory uses of risks for
20 all plants. And those include the maintenance rule,
21 the reactor oversight process, I guess the DRAP and
22 other things for the new plants.

23 And I know the staff has suggested that
24 there needs to be some period of where we accumulate
25 data before we can use applications. I would just

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1 note that it seems like that would apply to mandatory
2 as well as voluntary applications. And somehow we
3 have got to come to grips with that. You know, I
4 would like to think we don't have to operate these
5 plants for years and years before we can take
6 advantage of some of these things.

7 MR. ADER: It's a good point, Biff. Is
8 NEI's or the industry's position that you ought to be
9 able to use the voluntary initiatives essentially from
10 day one, fuel load?

11 MR. BRADLEY: That's a good question. I
12 don't think we have established a formal position on
13 that and really gone back, but I think our thinking
14 would be that that would be desirable. But we would
15 have to see if we could justify that. But I really
16 would like to think that we could -- certainly if
17 there are certain things you are doing from day one
18 with the ROP and the maintenance rule, it seems like
19 whatever rationale you have for that ought to apply to
20 the other applications as well.

21 MR. ADER: Yes. And I personally saw some
22 of those concerns. And the issue is that, by and
23 large, I don't want to say every SSC, every component
24 in a new reactor design is very similar to an existing
25 reactor. You can think really big squib valves and

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1 things like that. But the normal complement of pumps
2 and pipes and valves and diesel generators and circuit
3 breakers and wires and all that sort of stuff --

4 MR. BRADLEY: Materials.

5 MR. ADER: -- materials pretty much look
6 the same. And it's not clear to me how operating a
7 fixed number of new plants for a few years will give
8 you very much useful operating experience unless, for
9 some reason, the equipment is really, really bad. If
10 it's really, really good, as is most equipment,
11 accumulating a few more years of no failures doesn't
12 do anything for you. If it's really, really bad, you
13 are going to see it.

14 MR. BRADLEY: Right.

15 MR. ADER: So it's not clear to me what
16 that operating -- with the exception of some perhaps
17 very different pieces of equipment, for which there
18 isn't a comparable --

19 MR. BRADLEY: I understand. I know there
20 has been a lot of discussion on the squib valves. I
21 guess we need to take some initiative, both we and the
22 staff, to come to grips with this as sort of an aside
23 after a period of what we're talking about.

24 MR. ADER: It's interesting that you
25 brought it up because it was one thing that I kind of

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1 stumbled over a bit also.

2 PARTICIPANT: That's one of the issues
3 that we're trying to work through on the tech specs is
4 how they account for lack of their own operating
5 experience. The staff work is working that issue.
6 How it comes out is --

7 CHAIR STETKAR: It's an important issue
8 because, you know, the question is how long do you
9 have to operate until enough is enough? If it's 35
10 years, it's not very much of an incentive. If enough
11 is enough is three years, it probably doesn't make any
12 difference compared to zero.

13 MR. BRADLEY: And I would note some of the
14 initiatives; for instance, 5.b, are dependent on
15 accumulating some operating experience. Don talked
16 about how that was primarily a deterministic
17 initiative, and he's correct. Some of these are
18 somewhat application-specific, but I think in general
19 we should be able to use these relatively early.

20 Getting back to the tabletops, I just
21 wanted to note that I thought this was a very
22 effective and well-conducted exercise. I thought both
23 industry and NRC staff had good participation and that
24 we really gave these a hard scrub.

25 We stayed consistent with the Commission

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1 directive. We had times where there was pressure to
2 go back and rethink the Commission decision. And we
3 all did a good job of keeping it constrained to the
4 direction the Commission gave us. We saw a little of
5 that even here today I think.

6 MEMBER SHACK: We didn't get the message.
7 (Laughter.)

8 MR. BRADLEY: Not that I would have
9 expected otherwise from this group.

10 And, as Don spoke, you know, I thought the
11 examples, while they were relatively stretched cases,
12 we also realized they had to be somewhat realistically
13 constrained. As, as he mentioned, a lot of these same
14 things you could set up under the current tech specs
15 or the current regulations. And you could create
16 similar extreme kinds of situations, where you just
17 know they don't happen. So I thought we did a good
18 job of that.

19 And my take-away here is we are in general
20 agreement with the conclusions that were presented by
21 the staff this morning. We really don't have any
22 major, substantive disagreements with what's in the
23 draft SECY, and I would note, you know, in the
24 licensing applications, there were very minor gaps or
25 essentially no real gaps identified. I think there

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1 were some minor things, maybe the maintenance rule.
2 We're obviously satisfied with that conclusion and in
3 agreement with it.

4 Having written a lot of these guidance
5 documents over the years, we went to great efforts to
6 build in backstops and deterministic considerations.
7 They weren't risk-based. And I guess I'm not
8 surprised with this result. That just confirms that
9 when we wrote these, we had the right considerations
10 in place.

11 On the ROP, again, I think we're in
12 essential agreement with the conclusions that were
13 presented that the certain elements of MSPI are not
14 going to be applicable to the new designs. And there
15 will need to be some thought given to some replacement
16 for that.

17 And, again, the idea that you need some
18 quantitative considerations to account for things such
19 as diversity, redundancy, what have you, that the
20 fundamental safety philosophy of the plant, we're
21 supportive of that. I think there have been some
22 qualitative considerations that are in the current
23 ROP. And as long as there are good, objective, clear,
24 qualitative, there's nothing wrong with something
25 being qualitative versus quantitative. We don't want

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1 subjective, fuzzy stuff in there, but good qualitative
2 considerations can sometimes be very effective. And
3 I think this may be a case where qualitative
4 considerations relative to those design philosophies
5 or features are a good way to revise the ROP for these
6 plants.

7 Again, this is a devil in the details kind
8 of question. And, as the staff alluded, there will be
9 a significant amount of interaction to come to grips
10 with exactly what those would be.

11 MEMBER RAY: Well, Biff, let me try and
12 get out the details here and just say it's asserted --
13 I've had this assertion made to me in the course of
14 our conducting reviews here that "Oh, that is
15 investment protection" -- you've heard that term used,
16 I'm sure -- "investment protection. And, therefore,
17 it's our business what we do with its operability and
18 procurement and design" and so on, which is fair
19 enough, I think.

20 I have gotten into some controversies,
21 though, when credit is taken for investment protection
22 when it comes to calculating risk. And I think that
23 is where this dilemma arises.

24 If one did not take credit for investment
25 protection and took the position that "It's my secret

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1 what emergency diesel generators I provide. It's none
2 of your business" and I don't take any credit for it,
3 if one were to do that, would that change what you
4 just said about these features and how we all should
5 learn to get along, I guess, together and taking
6 appropriate attention of them and so on?

7 MR. BRADLEY: That is a question I guess
8 that sounds rather profound. I don't know if I want
9 to answer it quickly.

10 MEMBER RAY: It's very real. In this very
11 room here, we've had --

12 MR. BRADLEY: I think it would. I mean,
13 I guess my sense is that, well, one, we don't do that.
14 I mean, these things are treated. Even though they
15 are just for investment protection, there is
16 regulatory treatment of these items.

17 MEMBER RAY: Well, that is what we are
18 talking about, an aspect of the regulatory treatment,
19 aren't we?

20 MR. BRADLEY: Whether we do -- well, your
21 question, I'll have to give it some more thought.

22 MEMBER RAY: Yes. I just want you to know
23 that there are times when your associates would like
24 us to view them as merely investment protection.

25 MR. BRADLEY: I guess that's not my

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1 personal view, --

2 MEMBER RAY: Okay.

3 MR. BRADLEY: -- you know, that all of
4 this is investment protection, but I will take that
5 back and see if we can get a good answer.

6 MEMBER RAY: Well, this is not easy.
7 Okay? In other words, I don't mean to say we
8 shouldn't recognize the risk-benefits of these things.
9 But, you know, there come times when you seek to
10 impose what seem to be rational requirements on things
11 and they're off the table, prohibited, "Don't talk
12 about that because it's in this category of investment
13 protection."

14 So, anyway, I'll leave it there. You
15 don't need to answer it. I just think it's a part of
16 the dilemma that we struggle with here.

17 MR. BRADLEY: Right. I mean, it even I
18 think comes up a little bit back to this relative risk
19 discussion we have been having. And if you were not
20 going to credit those additional equipments for
21 whatever risk reduction that they provide --

22 MEMBER RAY: Say I don't.

23 MR. BRADLEY: -- then maybe you should be
24 under -- you know, maybe your ROP should take that
25 into consideration. If you desire to do that, that's

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1 sort of making a case in a way for the relative --
2 generally, as you might have figured out, I'm not a
3 big fan of that.

4 And we went back. We did spend quite a
5 bit of thumb back a year or two ago making the case on
6 why we thought that wasn't a good way to go. And we
7 had a paper that was I think discussed with this group
8 as well as provided with the Commission that laid all
9 of that out.

10 Primarily it just comes down to,
11 especially in the ROP, I think the concern with
12 punishing the good deed of making the plant safer.
13 And so that --

14 MEMBER RAY: Believe me, if I had an
15 AP1000, I definitely would not want to have some of
16 the safety-related systems activated. I would much
17 rather use my investment protection equipment. And so
18 I have a motivation to put it there other than safety.
19 It's to make it so that I have some chance of
20 operating the plant in the future. So it's not just
21 altruistically installed.

22 And I'm sympathetic to the idea that, wait
23 a minute, I put this in here because I wanted to not
24 activate those damn --

25 MR. BRADLEY: Squib valves?

1 MEMBER RAY: -- squib valves. And so now
2 why are you punishing me because I haven't? So okay.
3 Never mind. We've talked about it enough.

4 MR. BRADLEY: I think I understand where
5 you are coming from. And maybe that's an angle we can
6 think about.

7 With regard to the ex-vessel severe
8 accident change process, again, I don't have a lot to
9 add, as Don indicated, I guess I haven't had the
10 benefit of lengthy discussions with OGC or anything,
11 but it's still not totally clear to me why you need
12 both the tier 1 and the tier 2 controls that are being
13 proposed. I guess we believe if you put an adequate
14 description in tier 1, the problem is solved.

15 It appears to us that, in reality, this
16 has not been a gap. Thais is a gap on paper. And the
17 designs that have been looked at, those features that
18 were important, whether it's ex-vessel or in-vessel,
19 found their way into tier 1. So it seems to me that
20 just continuing that or making sure that that
21 continues solves the problem.

22 Obviously, you know, the change process is
23 getting pretty cumbersome for these plants. We more
24 than double the volume of change control guidance
25 going from operating plants to new plants already. So

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1 we have a whole other set of stuff in tier 2, I guess.
2 You know, in my mind, if we could avoid that, that
3 would be beneficial. And probably we would prefer to
4 make sure the tier 1 description is going to do the
5 job.

6 So, all of that being said, you know,
7 again, a great effort, good interaction. And we
8 really don't have substantive policy disagreements or
9 substantial disagreements with where this has come
10 out. I will say I think if we are going to rethink
11 this now and possibly go back to putting relative risk
12 in as another option I would certainly not make that
13 same statement. I would have to go back and look at
14 what is getting added and what other options are being
15 put in. And we would have to rethink these
16 conclusions that you see here.

17 But, as the paper is currently written,
18 you know, we're substantively okay with it.

19 CHAIR STETKAR: Any members have any
20 questions for NEI? If not --

21 MEMBER SCHULTZ: I have one question.
22 Biff, in the last bullet, what type of interaction?
23 You had this opportunity for the industry-NRC
24 workshops that occurred in the last year and a half.
25 So in terms of the upcoming dialogue and

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1 participation, what would the industry be looking for
2 in terms of interaction with the staff?

3 MR. BRADLEY: This is in ROP space you are
4 referring to?

5 MEMBER SCHULTZ: Yes.

6 MR. BRADLEY: I would assume it would be
7 through public meetings and through the normal
8 processes we have set up right now. I think we have
9 monthly ROP interactions on operating plants. But
10 just through the normal public process to build the
11 guidance, just that's what I had in mind, I mean,
12 nothing extraordinary.

13 MEMBER SCHULTZ: Thanks.

14 CHAIR STETKAR: Anything else?

15 (No response.)

16 CHAIR STETKAR: Biff, thank you very much.
17 I appreciate it. And I think we understand each
18 other.

19 Right now is there any member of the
20 public here who would like to make any comments or ask
21 any questions?

22 We had a bridge line, phone bridge line,
23 open, trying to get that opened up for two-way
24 communications. If there indeed is someone out there
25 listening, could you do us a favor and just make some

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1 sign so that we know that the bridge line is open? We
2 have no way of knowing that it's actually open in this
3 direction. If somebody is out there, just anybody say
4 something, just anything, so we know it's open.

5 (No response.)

6 CHAIR STETKAR: Hearing silence, I'm going
7 to interpret that as there's no one there. So, with
8 that, we've satisfied that.

9 Now, a couple of points of business.
10 Let's go around the table as well and see if any of
11 the members have any final comments or questions on
12 anything. And I'll start with Jack.

13 11. DISCUSSION AMONG MEMBERS

14 MEMBER SIEBER: Okay. I generally agree
15 with what the staff has done. And I think we are
16 ready to proceed ahead with the overall plan.

17 CHAIR STETKAR: Steve?

18 MEMBER SCHULTZ: I concur. I think that
19 I really appreciate the workshop approach that has
20 been used here. I think that the staff has gained
21 great value through that process and has very
22 informative information to bring forward to the
23 Commission as a result.

24 CHAIR STETKAR: Dick?

25 MEMBER SKILLMAN: I commend the staff for

1 having completed a significant amount of important
2 work. Thank you.

3 CHAIR STETKAR: Dennis?

4 MEMBER BLEY: A very good open interaction
5 today. I have nothing to add.

6 CHAIR STETKAR: Harold?

7 MEMBER RAY: I think I have expressed my
8 -- I am more trying to learn what is a changing
9 environment and what the implications of it are. I
10 mentioned this.

11 CHAIR STETKAR: Said?

12 MEMBER ABDEL-KHALIK: I have no additional
13 comments.

14 CHAIR STETKAR: Bill?

15 MEMBER SHACK: No.

16 CHAIR STETKAR: Joy?

17 MEMBER REMPE: No comments.

18 CHAIR STETKAR: And I have nothing to add.
19 I've said all I need to.

20 So, staff, do you have a decent idea? I
21 don't know how long we have allocated, probably an
22 hour and a half, I'm guessing, at the full Committee
23 meeting.

24 MR. FRAHM: That sounds right.

25 CHAIR STETKAR: You know, obviously, the

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1 full Committee will be interested in the paper itself,
2 the conclusions and the recommendations. And I would
3 say certainly the tabletop exercise experience that
4 drives some of the major conclusions, the ROP
5 information, and the ex-vessel severe accident, I
6 think you certainly want to highlight those.

7 MR. FRAHM: Okay.

8 CHAIR STETKAR: Some of the other staff as
9 far as details of what was done in the tabletops, it's
10 really interesting information, but I don't want to
11 get hung up on that as a prelude to making sure that
12 the full Committee understands the basic thrust of the
13 Commission paper and the different options and the
14 final conclusions and the basis for how those were
15 derived.

16 MR. DUBE: Okay. Yes. I think if you
17 look at this afternoon's session where I summarize the
18 results and the recommendations, that's like 45
19 minutes or 50 minutes. And then I can augment that
20 with general tabletop experience, a little more detail
21 on ROP and ex-vessel. That will take us into an hour
22 and a half.

23 CHAIR STETKAR: Well, is NEI going to have
24 a -- have you talked to John at all? Do you want to
25 say anything?

1 MR. BRADLEY: My sense is we will be at
2 the meeting, but I don't think we need to present.
3 But we will be here, and we will stand up if we need
4 to.

5 CHAIR STETKAR: Okay. Thank you.

6 MEMBER SHACK: What do we hear from the
7 peanut gallery? We're kind of arguing that maybe the
8 ex-vessel -- you could spend your time better on the
9 desktop exercises.

10 CHAIR STETKAR: That may be very well
11 true. The ex-vessel in my mind is not directly
12 relevant to the fundamental issue of risk metrics --

13 MEMBER SHACK: Risk metrics.

14 CHAIR STETKAR: -- and how they are used.

15 MEMBER SHACK: Cleaning up.

16 CHAIR STETKAR: Do the other Subcommittee
17 members agree to that?

18 (Whereupon, there was a chorus of "Yes.")

19 MEMBER BLEY: I think focusing on the
20 tabletops and where that led --

21 CHAIR STETKAR: Okay. In that case, since
22 the full Committee hasn't heard anything about the
23 first set of tabletops -- remember, you came last
24 whenever.

25 MR. DUBE: Correct. September, yes.

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1 CHAIR STETKAR: September. Let's decide
2 to do that. Kind of downplay the ex-vessel. Even
3 though it is kind of highlighted --

4 MR. BRADLEY: Yes.

5 CHAIR STETKAR: -- in the paper itself, I
6 think you can work through that. I think that the
7 message from the RITS 4b and the tabletops for that is
8 important, only because of the extensive work that you
9 did do.

10 MR. BRADLEY: Right.

11 CHAIR STETKAR: And the basis for the
12 conclusions that the 30-day backstop and other
13 considerations provide the limitations on just
14 infinite allowed outage times for some -- so I think
15 that would be useful in terms of that whole first set
16 of things.

17 MR. BRADLEY: How about the LRF to LERF
18 transition? Was that high on the list or low on the
19 list?

20 CHAIR STETKAR: I personally think that's
21 low on the list only because I can see the full
22 Committee getting into an excruciating discussion
23 about the philosophy. And that's not directly germane
24 to kind of this issue of risk metrics.

25 MEMBER SIEBER: I agree with you.

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1 CHAIR STETKAR: What do the other members
2 think about that?

3 MEMBER BLEY: Yes. I agree. I don't see
4 that as --

5 MEMBER SIEBER: What's hard to explain is
6 the switchover.

7 MEMBER BLEY: And it could be a great time
8 sink.

9 CHAIR STETKAR: I think it could be a
10 great time sink. I agree.

11 MR. DUBE: Okay. So we'll emphasize the
12 key tabletop exercises, certainly from the first set,
13 especially RITS 4b, and some of the interesting ROP
14 results.

15 MEMBER BLEY: And how they track the
16 recommendations.

17 MEMBER SKILLMAN: I think we've got to
18 mention LERF, but I think it can be offered in
19 passing, as opposed to strong margin on it.

20 CHAIR STETKAR: They have to mention LERF,
21 and they have to mention the --

22 MR. BRADLEY: CCDF.

23 MR. FRAHM: Ex-vessel.

24 CHAIR STETKAR: -- EVSA, only because they
25 are elements of the paper going up. So there has to

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1 be, you know, some de minimis discussion of that topic
2 in the context but not to the level of detail --

3 MR. BRADLEY: Sure.

4 CHAIR STETKAR: -- that we heard today.

5 MEMBER SCHULTZ: Or the conclusions and --

6 CHAIR STETKAR: Or the conclusions and
7 kind of -- yes.

8 MR. BRADLEY: Got it.

9 CHAIR STETKAR: And, you know, as you
10 presented the LRF to LERF, you know, just noting the
11 kind of consistency across the fleets.

12 Anything else? Any other member comments?

13 (No response.)

14 CHAIR STETKAR: If not, I would like to
15 thank the staff.

16 MEMBER SIEBER: Thank you.

17 CHAIR STETKAR: You covered an awful lot
18 of material today. I think we have --

19 MR. DUBE: That was a lot of material.

20 CHAIR STETKAR: I think we learned a lot.
21 I think we really appreciate, you know, all you have
22 been through through the last year with all of these
23 tabletops and the industry, too. I think that this is
24 an example of really good cooperation to address, you
25 know, an important topic that does affect not just

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1 licensing basis. But, more importantly, I think it
2 affects how people proceed after the new plants are
3 operating.

4 And I would really like to congratulate
5 everybody on a job well done. And I think you did a
6 very good job summarizing things today.

7 And, with that, we're adjourned.

8 (Whereupon, the foregoing matter was
9 concluded at 4:07 p.m.)

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U.S. NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

RISK-INFORMED REGULATORY FRAMEWORK FOR NEW REACTORS

Advisory Committee on Reactor Safeguards Subcommittee on Reliability and PRA

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March 7, 2012



Meeting Purpose

Discuss second series of tabletop exercise results and staff's response to the SRM on SECY-10-0121

Agenda

- **Tabletop exercise results**
 - **50.69 SSC classification**
 - **RG 1.174**
 - **LRF to LERF transition**
 - **Change process for ex-vessel severe accident features**
 - **Reactor oversight process**
- **Conclusions, options and recommendations in draft paper**
- **Next steps**

Options Provided in SECY-10-0121

- 1) No changes to existing risk-informed guidance (status quo)**
- 2) Implement enhancements to existing guidance to prevent significant decrease in enhanced safety (NRC staff recommendation)**
- 3) Develop lower numeric thresholds for new reactors**

Commission SRM

Dated March 2, 2011

- **Commission approved a hybrid of Options 1 and 2**
 - Continue existing risk-informed framework pending a series of tabletop exercises that test existing guidance

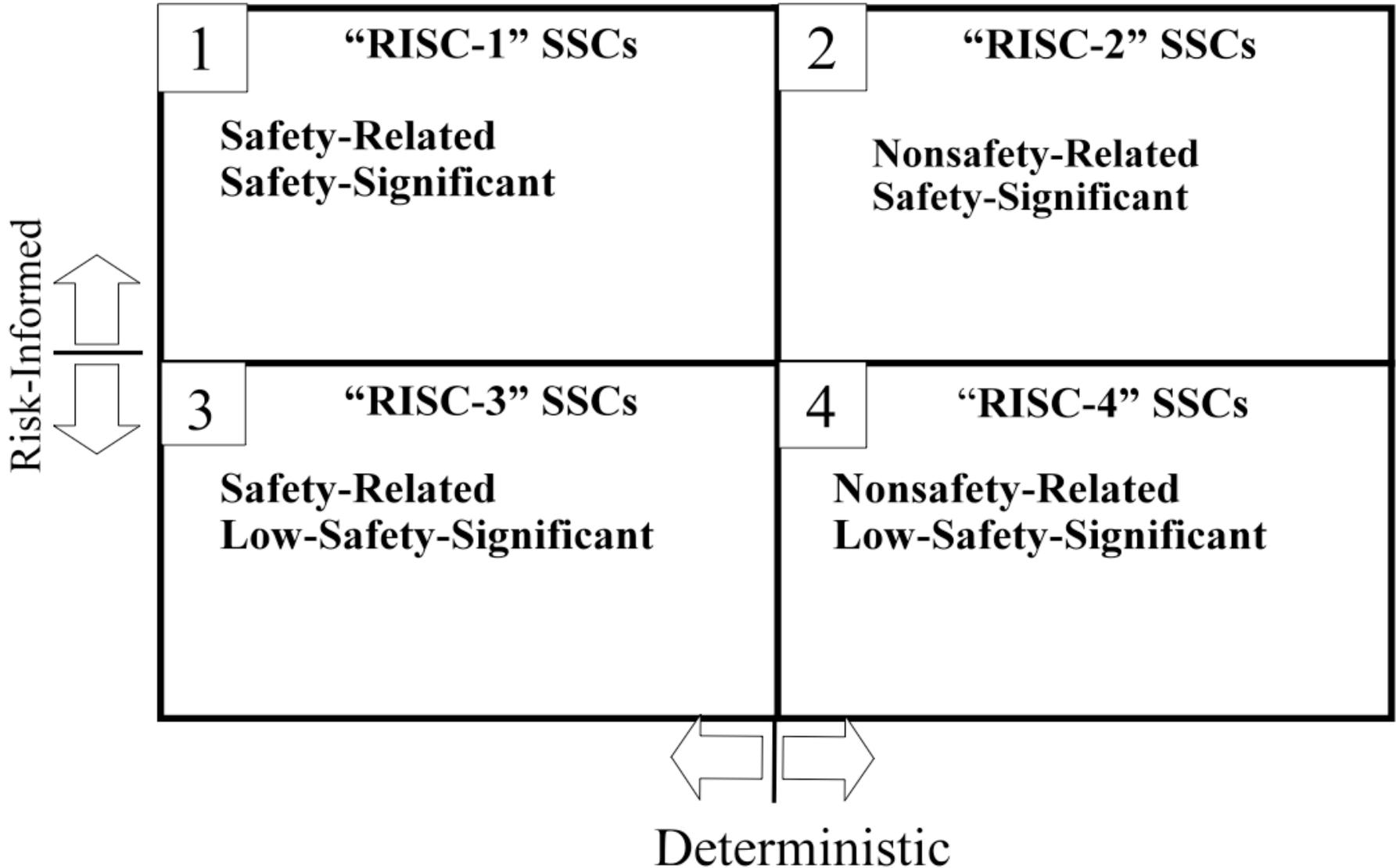
- **Commission “reaffirms” existing**
 - safety goals
 - safety performance expectations
 - subsidiary risk goals and associated risk guidance
 - key principles (e.g., RG 1.174)
 - quantitative metrics

- **Commission expects:**
 - Advanced technologies in new reactors will result in enhanced margins of safety
 - As a minimum, new reactors have the same degree of protection of the public and environment as current generation LWRs
- **New reactors with these enhanced margins and safety features should have greater operational flexibility than current reactors**

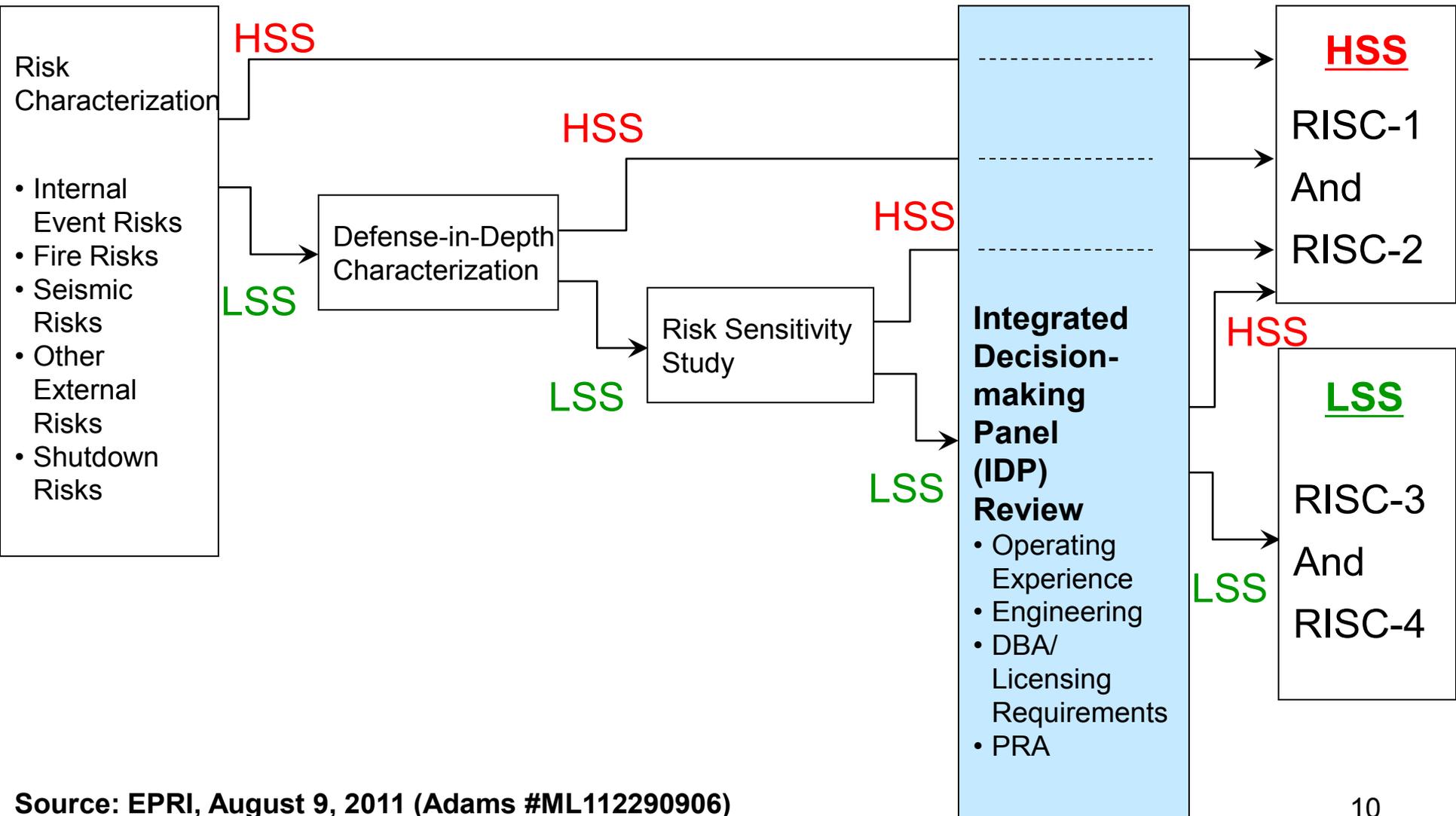
Tabletop Exercises

- December 2, 2010: 50.59-like change process for ex-vessel severe accident (EVSA) design features under Section VIII.B.5.c of each design certification rule
- May 4, 2011: Risk-informed inservice inspection of piping
- May 26, 2011 and June 1, 2011: Risk-Informed Technical Specifications (RITS) Initiative 4b on completion times and the Maintenance Rule (a)(4)
- June 29, 2011: RITS Initiative 5b (surveillance frequency control program)
- August 9, 2011: 50.69 and guidance in NEI 96-07 Appendix C on the change processes for Part 52 specific to EVSA design features
- October 5, 2011: RG 1.174; transition options from large release frequency (LRF) as a risk metric to large early release frequency (LERF); and ROP risk-informed case studies including SDP, reactive inspections under Management Directive 8.3, and MSPI
- October 26, 2011: Follow-up discussions with stakeholders on the ROP

10CFR50.69 - Risk-Informed Categorization and Treatment of Structures, Systems, and Components for Nuclear Power Reactors



NEI 00-04 Risk-Informed Categorization



Application of 10CFR50.69 to New Reactors

Process assumes:

- Initial safety related/non-safety related classification of all equipment
 - Beneficial during procurement if SR equipment goes through 50.69 process prior to purchase
- Full scope PRA
 - PRA standard leans toward use of plant specific data for failure rate
- All functions are known
 - Beyond design basis functions

New Reactor Results

- Active PWR
 - New build vs. operating plant
 - Maximized percentage of SSCs in RISC-3
 - Likely reduced in the future

New Reactor Results (cont.)

- ESBWR
 - Focus on ESBWR
 - Components moved from RISC-1 to RISC-3

10CFR 50.69 Tabletop Results

- **50.69: No gaps**
 - New reactor design (PWR with active safety systems) compared to South Texas 1 & 2 pilot
 - Built-in measures to monitor RISC-3 components



Regulatory Guide 1.174

- **Five principles for making risk-informed decisions**
 - The proposed change:
 - Meets current **regulations** (unless exemption request)
 - Is consistent with the **defense-in-depth** philosophy
 - Maintains sufficient **safety margins**
 - Results in an increase in CDF or risk that is **small** and consistent with the intent of the Commission’s Safety Goal Policy Statement
 - Will be monitored using **performance measurement** strategies.

From RG 1.174

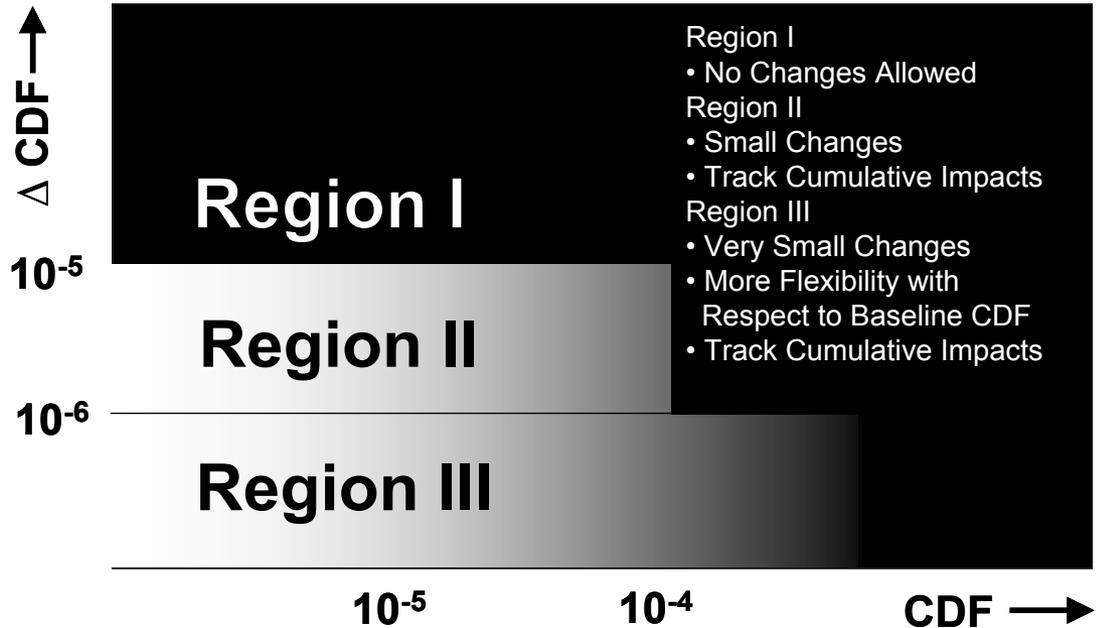


Figure 3. Acceptance Guidelines for Core Damage Frequency (CDF)

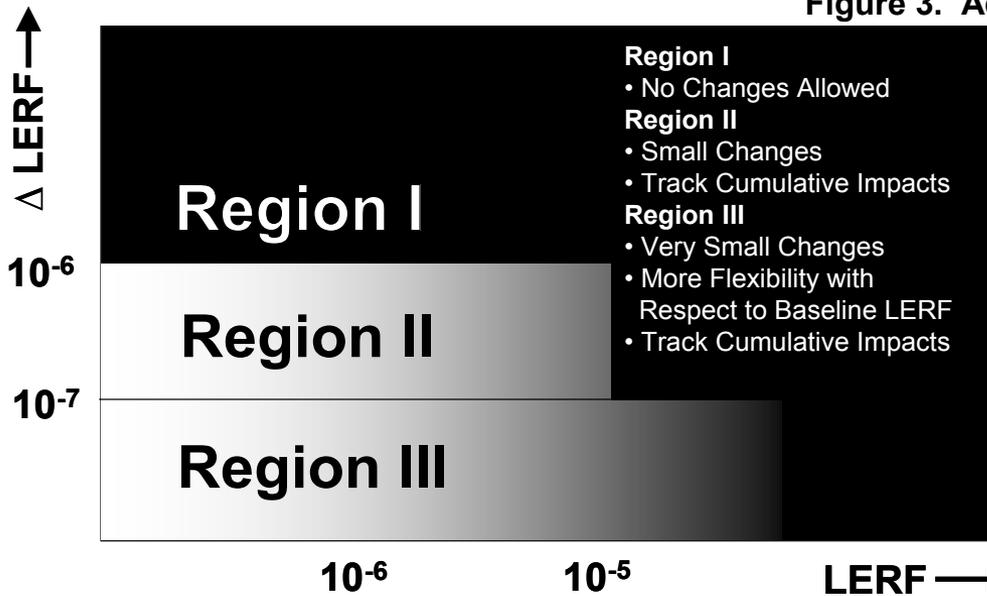


Figure 4. Acceptance Guidelines for Large Early Release Frequency (LERF)



RG 1.174 Cases

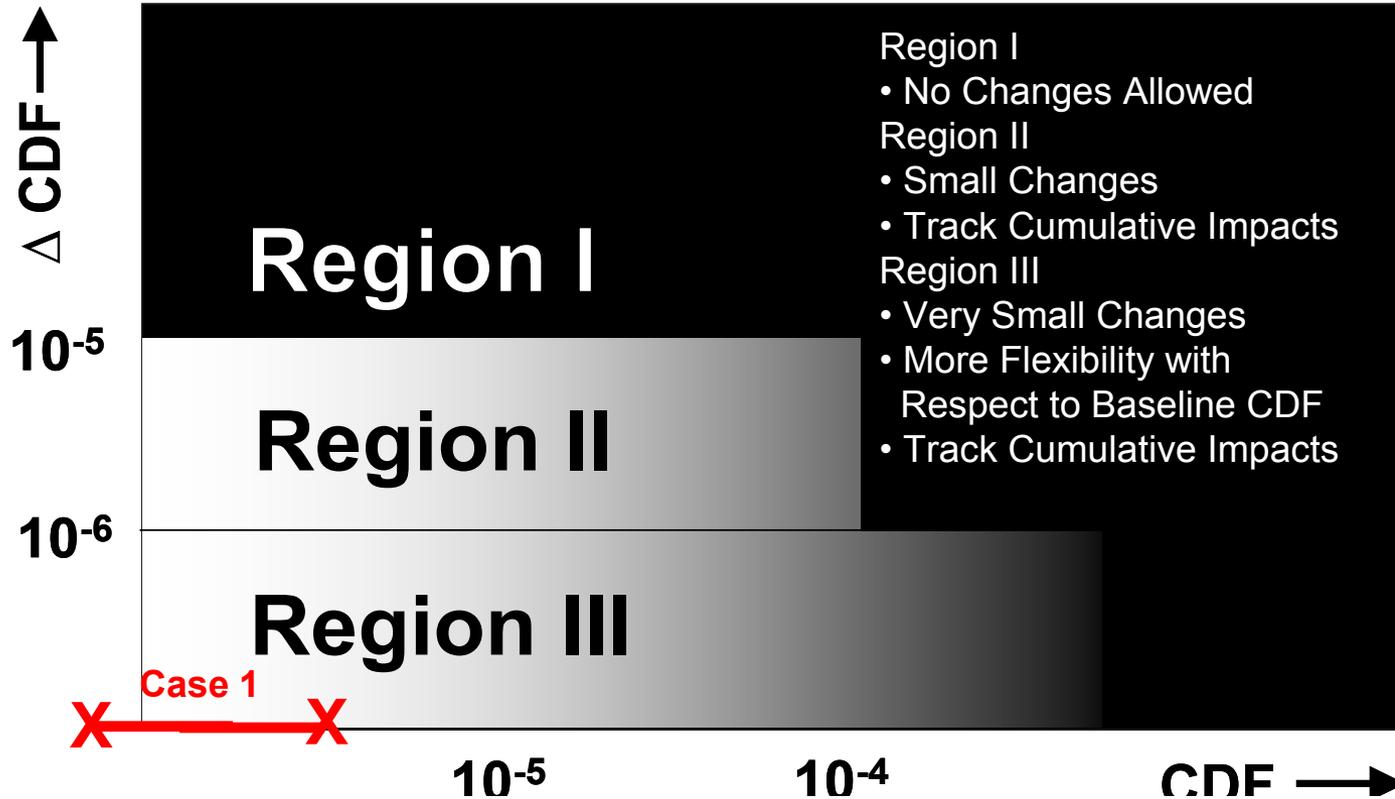
- ESBWR
- ABWR
- U.S. EPR
- US-APWR
- AP1000

Case 1: Tier 1 change to COPS (wetwell venting) to reduce rupture disk setpoint from 104 psia to lower value, and change two isolation valves from normally open to normally closed with operator action required for venting

$$\Delta\text{CDF} \sim 10^{-7} \text{ /yr}$$

Sources: ABWR SPAR Model, and DCD rev. 4 Section 2.14.6

ABWR Hypothetical Case



RG 1.174 Tabletop Results

- RG 1.174: No Gaps
 - Δ CDF observed to be very low
 - Close review by the staff:
 - Degradation of defense in depth
 - Changing from passive to active
 - Changes near boundary of region II



Transition from LRF to LERF

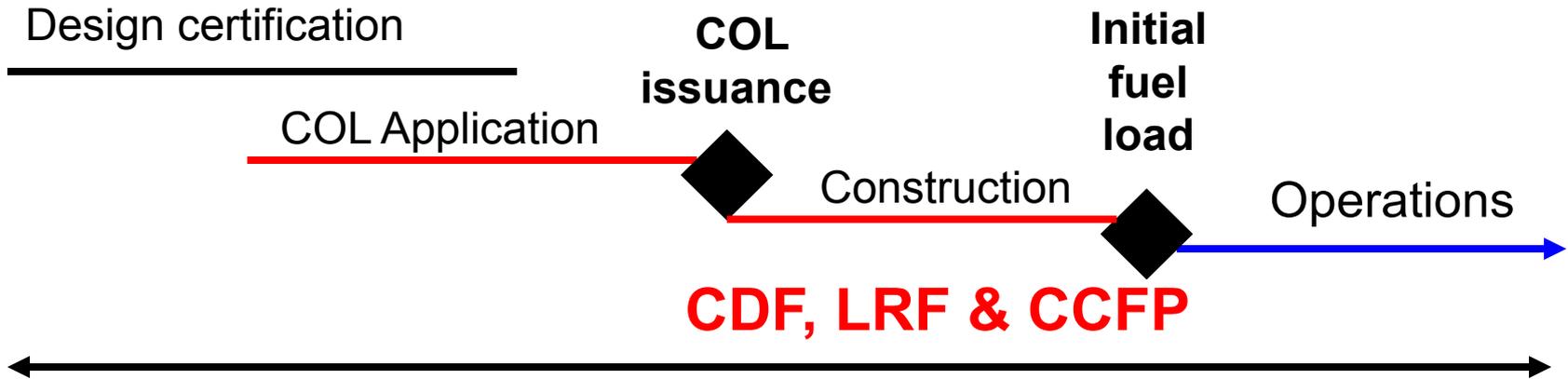
LRF-to-LERF Transition

- **LRF vs. LERF**
 - Commission goals for new reactors are based on a conditional containment failure probability (CCFP) of less than 0.1, and a LRF of less than $10^{-6}/\text{yr}$, as well as $10^{-4}/\text{yr}$ for core damage frequency (CDF)
 - Operating reactors use CDF and LERF as risk metrics
- **LRF issues**
 - LRF (and CCFP) have not been defined by the staff
 - Each design center has chosen different definitions
 - LERF is used in the ASME/ANS level 1 PRA standard, in risk-informed staff guidance (e.g., RG 1.174), and ROP
 - No existing or proposed level 2 PRA standard provides a universal definition of LRF

LRF-to-LERF Options

- **Option 2A: continue use of LRF (& CCFP) indefinitely**
- **Option 2B: continue use of LRF (& CCFP) indefinitely and add LERF at initial fuel load**
- **Option 2C: transition from LRF to LERF at or prior to initial fuel load; discontinue regulatory use of LRF (& CCFP) thereafter**

Option 2A

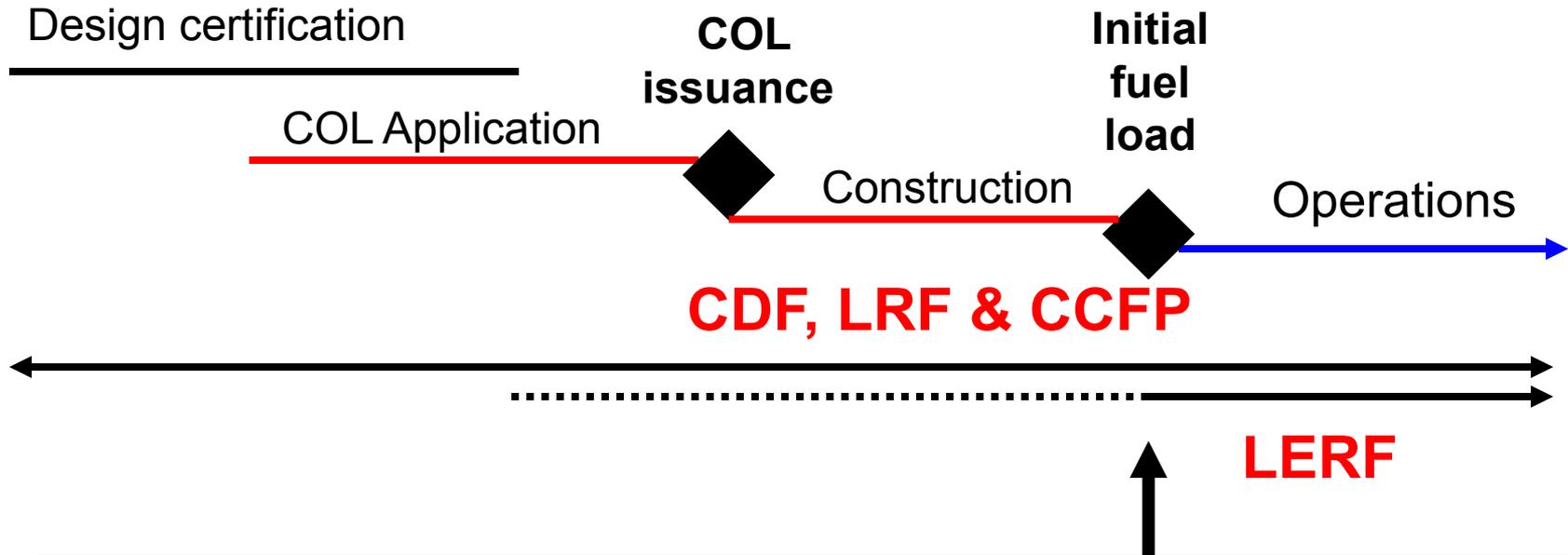


Option 2A

- **Advantage**
 - **Maintains definition and use of risk metrics consistent with original license application and staff review per FSER**

- **Disadvantages**
 - **No existing definition & guidance on use of LRF**
 - **May be inconsistent with SRM direction in which Commission “reaffirms that the existing ... quantitative metrics for implementing risk-informed decision making, are sufficient for new plants”**
 - **Issues with RG 1.174 and ROP which use LERF**

Option 2B



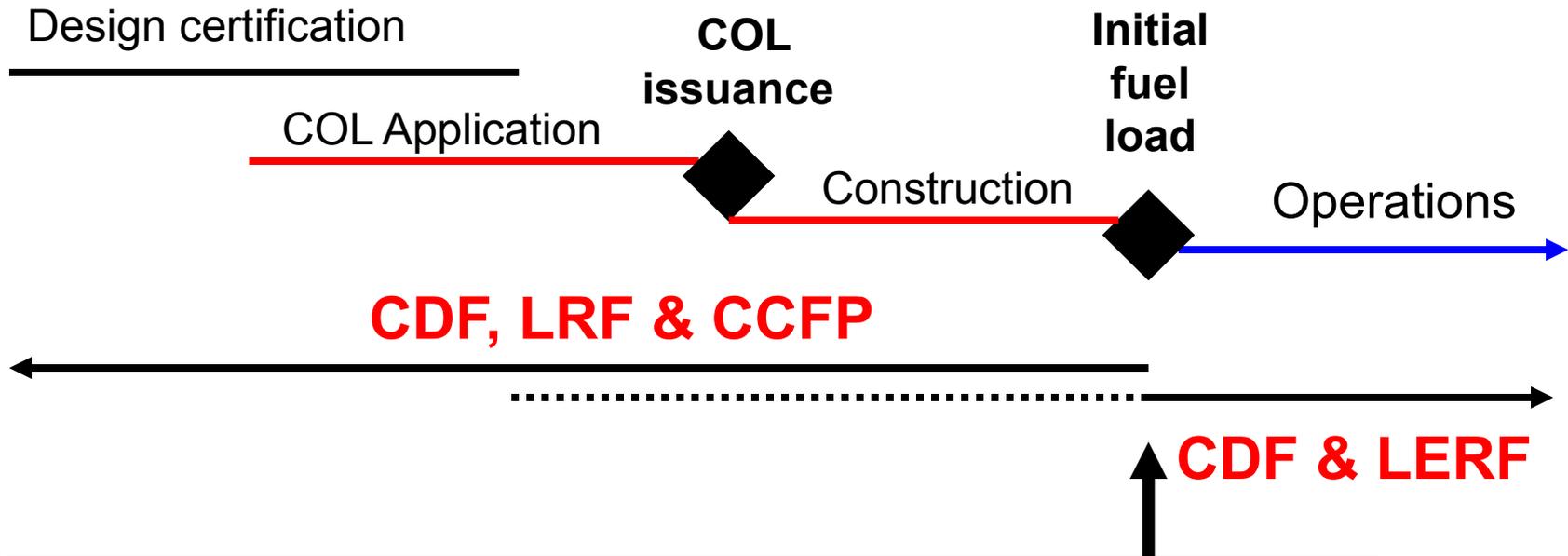
- LERF calculated at or prior to initial fuel load.
- LERF and CDF used for RG 1.174 acceptance guidelines going forward.

Option 2B

- **Advantages**
 - **Continued use of LRF & CCFP maintains definition and use of risk metrics consistent with original license application**
 - **Supports calculation of late containment failure impact per RG 1.174 rev. 2**
 - **Use of CDF & LERF for risk-informed changes to licensing basis consistent with RG 1.174 acceptance guidelines for currently operating reactors, as well as ROP**

- **Disadvantages**
 - **Added confusion by tracking both LRF & LERF**
 - **May be viewed as inconsistent with SRM direction**
 - **Added burden on licensees**

Option 2C



- LERF calculated at or prior to initial fuel load. CDF & LERF used for RG 1.174 acceptance guidelines going forward.
- Last regulatory use of LRF & CCFP

Option 2C

- **Advantages**
 - **Consistent with SRM direction**
 - **Harmonizes metrics for all operating reactors, both current and new, going forward**
- **Disadvantages**
 - **LRF & CCFP, part of original design objective in design certification, no longer tracked**
 - **LRF not available to assist in determining impact on late containment failure in RG 1.174**
 - **Augment discussion on long-term containment performance in Section 2.2 of RG 1.174 by referring to the containment performance objectives in SECY-90-016 and SECY-93-087**

Option 2C (cont.)

- **Containment performance objectives per SECY-90-016 and SECY-93-087:**

The containment should maintain its role as a reliable, leak-tight barrier (for example, by ensuring that containment stresses do not exceed ASME Service Level C limits for metal containments, or Factored Load Category for concrete containments) for approximately 24 hours following the onset of core damage under the more likely severe accident challenges and, following this period, the containment should continue to provide a barrier against the uncontrolled release of fission products.

Tier 2 changes to ex-vessel severe accident (EVSA) design features

Background

- **NEI 96-07, Guidance on 50.59, new Appendix C regarding Part 52 change process, for example:**
 - **Departures from Tier 1, Tier 2, and Tier 2***
 - **Effect on design basis accidents**
 - **Aircraft impact assessment and loss of large areas**
 - **Tier 2 changes to ex-vessel severe accident (EVSA) design features**
- **Public workshop on EVSA December 2, 2010**
- **Public meeting on EVSA draft guidance Aug 9, 2011**
- **Public meetings on NEI 96-07 Appendix C, in general, Nov 15, 2011, Jan 17, 2012, and Feb 14, 2012**

From Part 52 App. A (ABWR)

- **VIII.B.5.c. A proposed departure from Tier 2 affecting resolution of an ex-vessel severe accident design feature identified in the plant-specific DCD, requires a license amendment if:**
 - (1) There is a substantial increase in the probability of an ex-vessel severe accident such that a particular ex-vessel severe accident previously reviewed and determined to be not credible could become credible; or**
 - (2) There is a substantial increase in the consequences to the public of a particular ex-vessel severe accident previously reviewed.**

What is an EVSA Design Feature?

Per the Statement of Considerations for the ABWR Final Rule, the change process for EVSA applies only to “severe accident design features, where the intended function of the design feature is relied upon to resolve postulated accidents when the reactor core has melted and exited the reactor vessel and the containment is being challenged”

EVSA Design Feature (cont.)

“In addition, the Commission is cognizant of certain design features that have intended functions to meet ‘design basis’ requirements and to resolve ‘severe accidents.’ These design features will be reviewed under either VIII.B.5.b or VIII.B.5.c depending upon the design function being changed.”

10 CFR 52.47(a)(23) and 10 CFR 52.79(a)(38)

Design certification document to address challenges to containment integrity caused by:

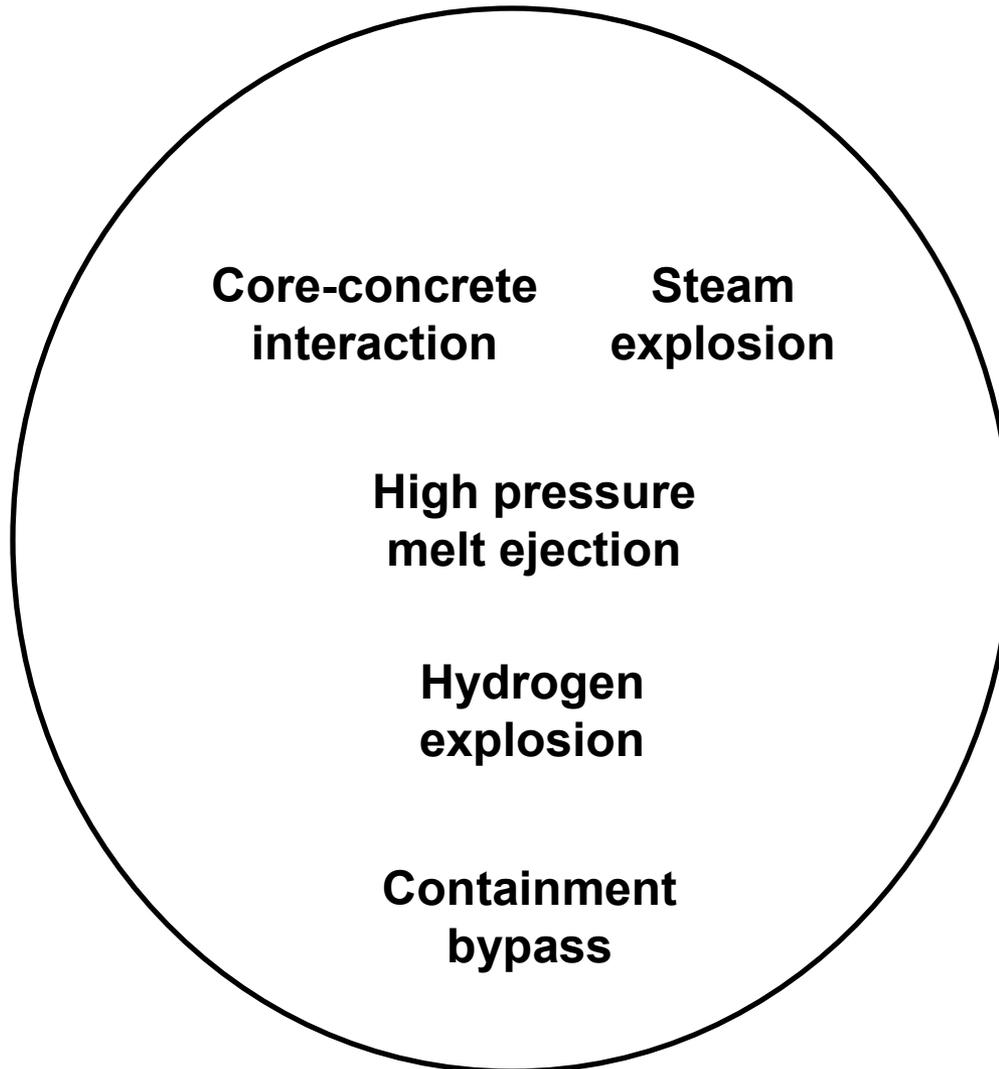
- **core-concrete interaction**
- **steam explosion**
- **high pressure core melt ejection**
- **hydrogen combustion, and**
- **containment bypass***

*** Consensus of December 2010 workshop participants that design features that prevent or mitigate containment bypass events are not in and of themselves EVSA features, and as such Section VIII.B.5.c criteria do not apply**

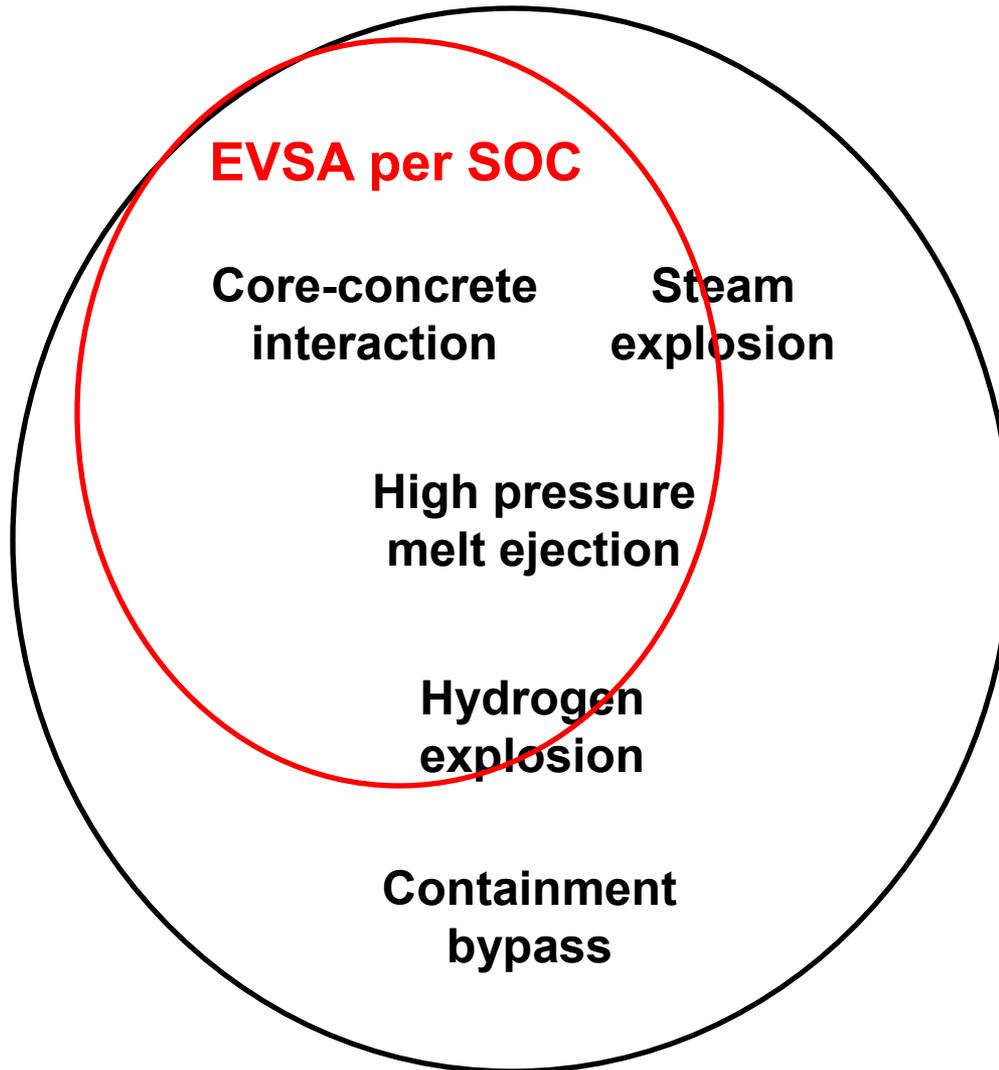
Tabletop Results on EVSA Design Feature Change Process

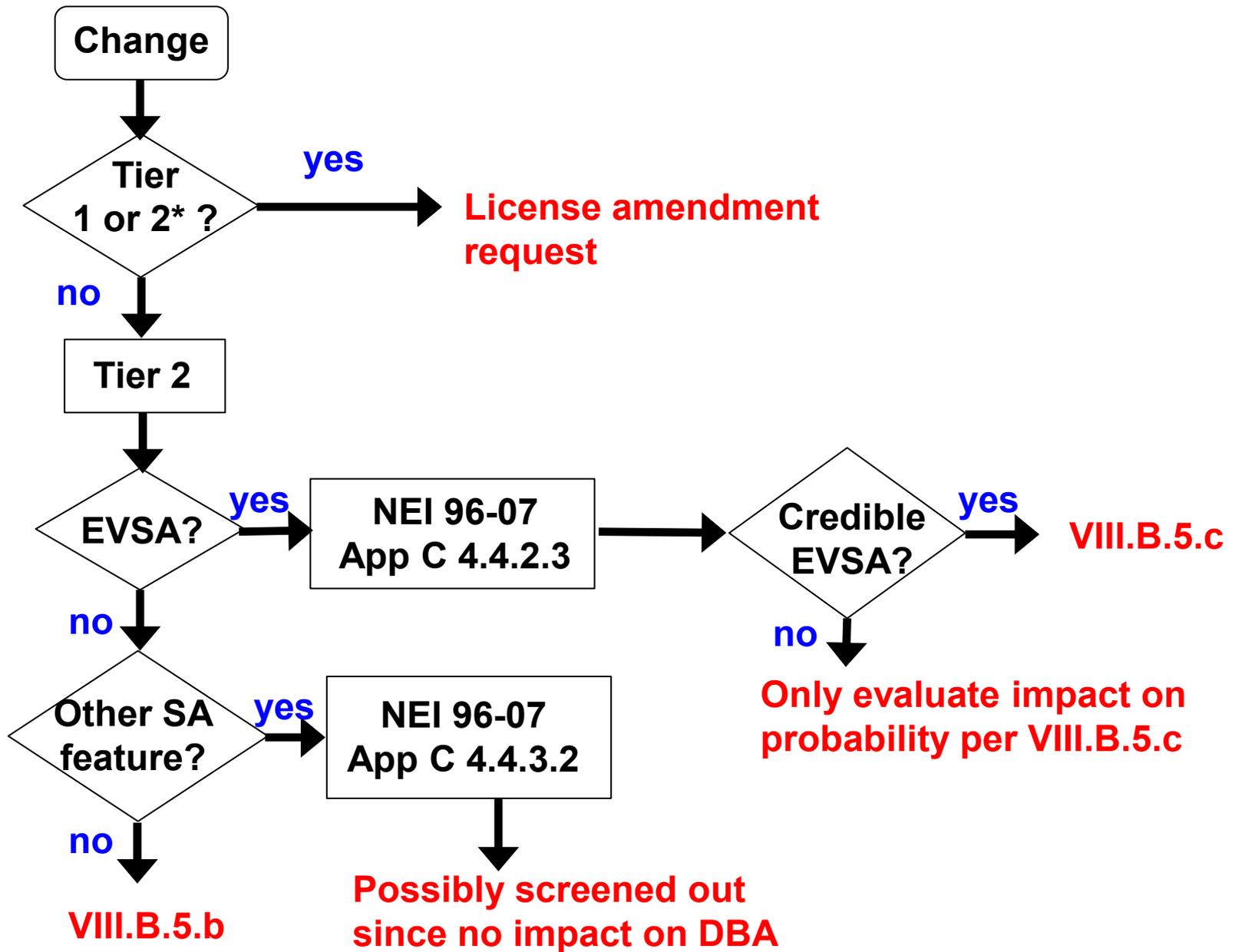
- **Certain severe accident features do not address “ex-vessel” conditions and VIII.B.5.c criteria do not apply (e.g., features to prevent ISLOCA / containment bypass)**
 - **Generally, enough details in Tier 1 that such features can not be removed and significant design changes are precluded**
- **Staff satisfied with “ex-vessel” portion of NEI 96-07 Appendix C Section 4.4.2.3; staff comments incorporated**
- **In a worst case, significant Tier 2 changes to non-ex-vessel severe accident features, up to and including permanent removal from service, could be made without prior NRC approval**

Containment Challenges per § 52.47(a)(23) & § 52.79(a)(38)



Gap Identified





Staff's Preliminary Gap Assessment

- **Staff reviewed severe accident features for ABWR, AP1000, and ESBWR**
- **No significant gaps of concern**
 - **Either it is an EVSA feature and VIII.B.5.c criteria will be used for Tier 2 changes, or**
 - **If it is a non-ex-vessel severe accident feature, there is generally sufficient detail in Tier 1 as to preclude a significant design change without prior NRC approval**
- **Staff is verifying preliminary conclusions**
- **Other standard designs eventually to be addressed**
- **Await Commission direction per Recommendation 1**

Example for ABWR

DESIGN	DESIGN FUNCTION & SSCs	EVSA * FEATURE?	AFFECTS PROBABILITY OR CONSEQUENCE OF EVSA?	DCD SECTION	GAP IN CHANGE PROCESS?
ABWR	AC-independent water addition system (ACIWA) provides the ability to flood the lower drywell via drywell sprays. It can also provide a means of injecting emergency makeup water to the reactor by cross connecting Division C of the RHR System to the Reactor Building Fire Protection System header, or alternately utilizing additional sources of water from an external connection just outside the Reactor Building.	YES, those aspects for flooding the lower drywell via drywell sprays	Consequences	Tier 1, Section 2.15.6 (very limited details) Tier 2, Section 19.8.7 Tier 2, Table 19.8-7	NO Evaluate under VIII.B.5.c Tier 1 changes require NRC approval
		NO, those aspects for injecting emergency makeup water into the reactor	Neither. This feature contributes to severe accident prevention but does not meet the definition of an EVSA feature.	Tier 1, Sections 2.4.1 and 2.15.6 Tier 2, Section 19.8.7 Tier 2, Table 19.8-7	NO Evaluate under VIII.B.5.b as appropriate only with regard to design basis accidents Tier 1 changes require NRC approval

AC Independent Water Addition Mode

Division C of the RHR System also functions in an AC independent water addition mode. This mode provides a means of injecting emergency makeup water to the reactor by cross connecting the Reactor Building Fire Protection (FP) System header, or alternately utilizing additional sources of water from an external connection just outside the Reactor Building. This makes it independent of the normal safety-related AC power distribution network. This mode is accomplished by manually opening two in-series valves on the cross-connection piping just upstream of the tie-in to the normal RHR piping. This is accomplished by local manual action at the valves. Fire Protection System water can be directed to either the RPV or the drywell spray sparger by local manual opening of the Division C RHR injection valve or the two Division C drywell spray valves. “Local manual” as used in this paragraph means manually operating the valves at the valves.



ROP Tabletop Exercises

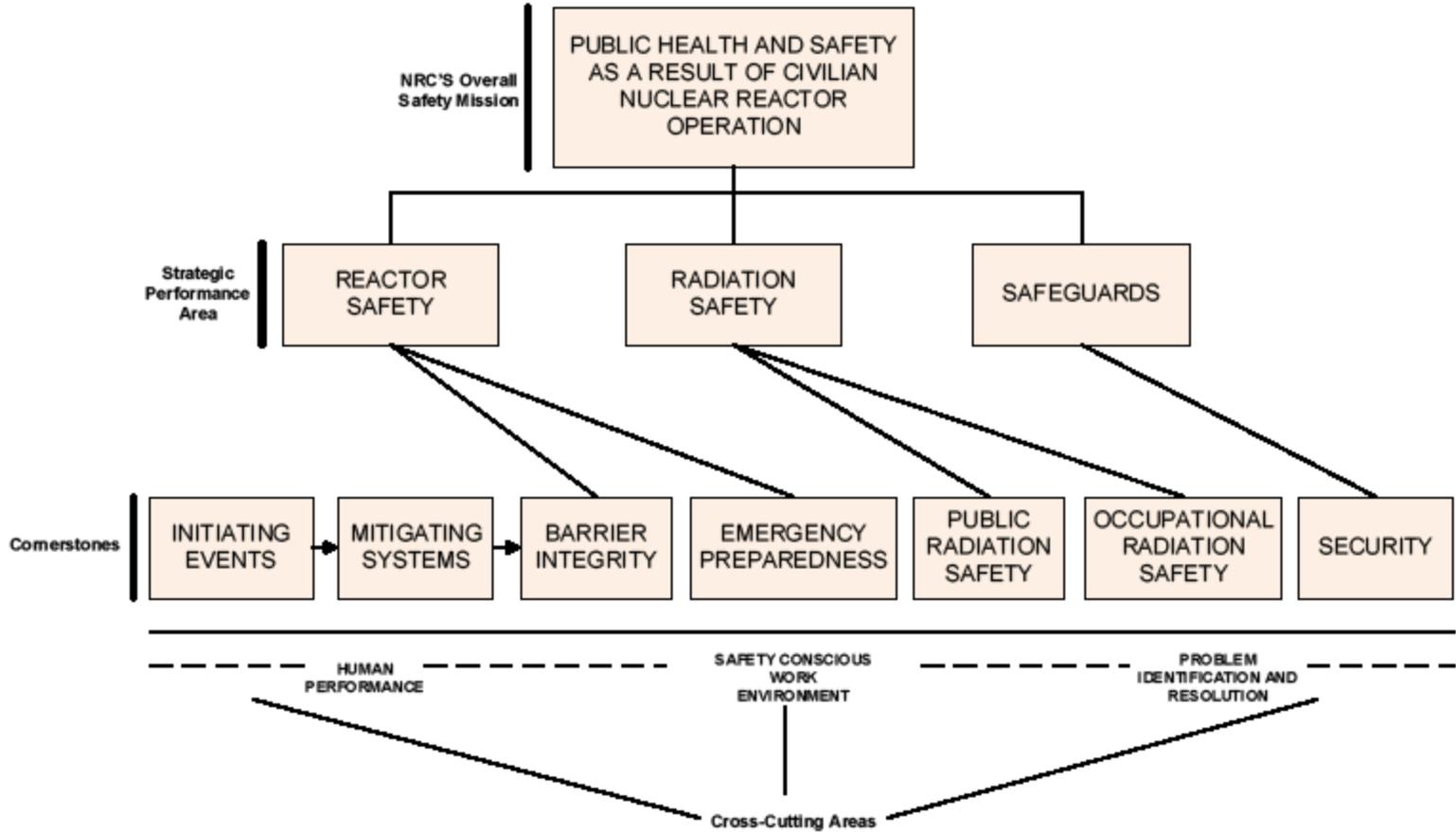
ROP Tabletop Exercises

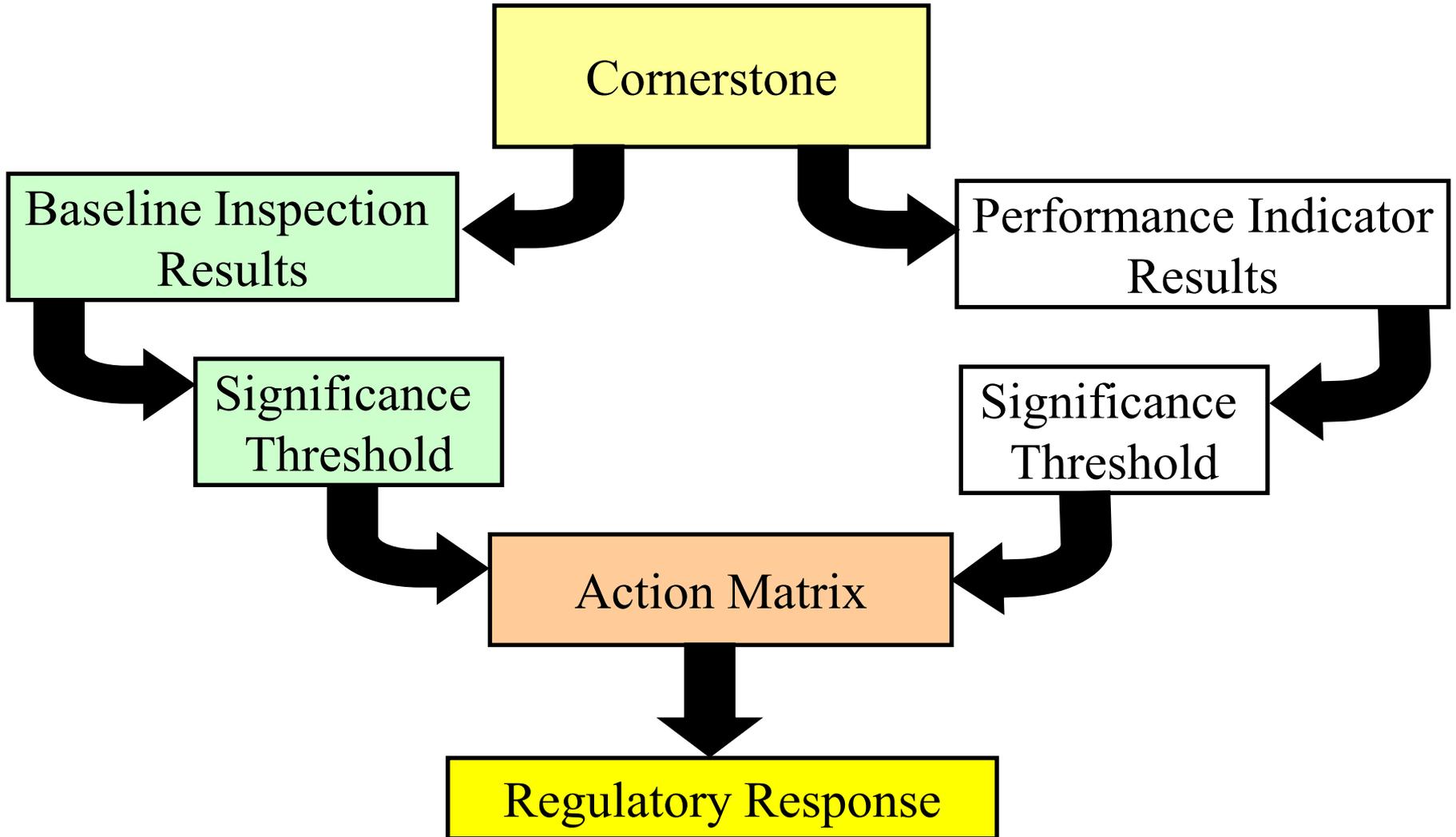
- ROP Background and Framework
- Existing Risk-informed Guidance and Thresholds
- ROP Tabletop Approach
- Tabletop Results and Conclusions
- ROP Options and Recommendation

Background: ROP Objectives

- Improve the Objectivity of the Oversight Processes - Subjective Decision-making is Minimized
- Improve the Scrutability of NRC Actions – Regulatory Response and NRC Actions Have a Clear Tie to Licensee Performance
- Risk-inform the Processes - NRC and Licensee Resources are Focused on Performance Deficiencies With the Greatest Impact on Safe Plant Operation

REGULATORY FRAMEWORK





SDP Guidance

- Implementation Guidance in IMC 0609, “Significance Determination Process,” and IMC 0609, Appendix A, “Determining the Significance of Reactor Inspection Findings for At-Power Situations”
- Appendix A and a few others use risk insights to inform regulatory response. Several other SDPs are more deterministic
- Risk thresholds are a function of changes in core damage frequency (CDF) and large early release frequency (LERF) against a plant’s baseline risk

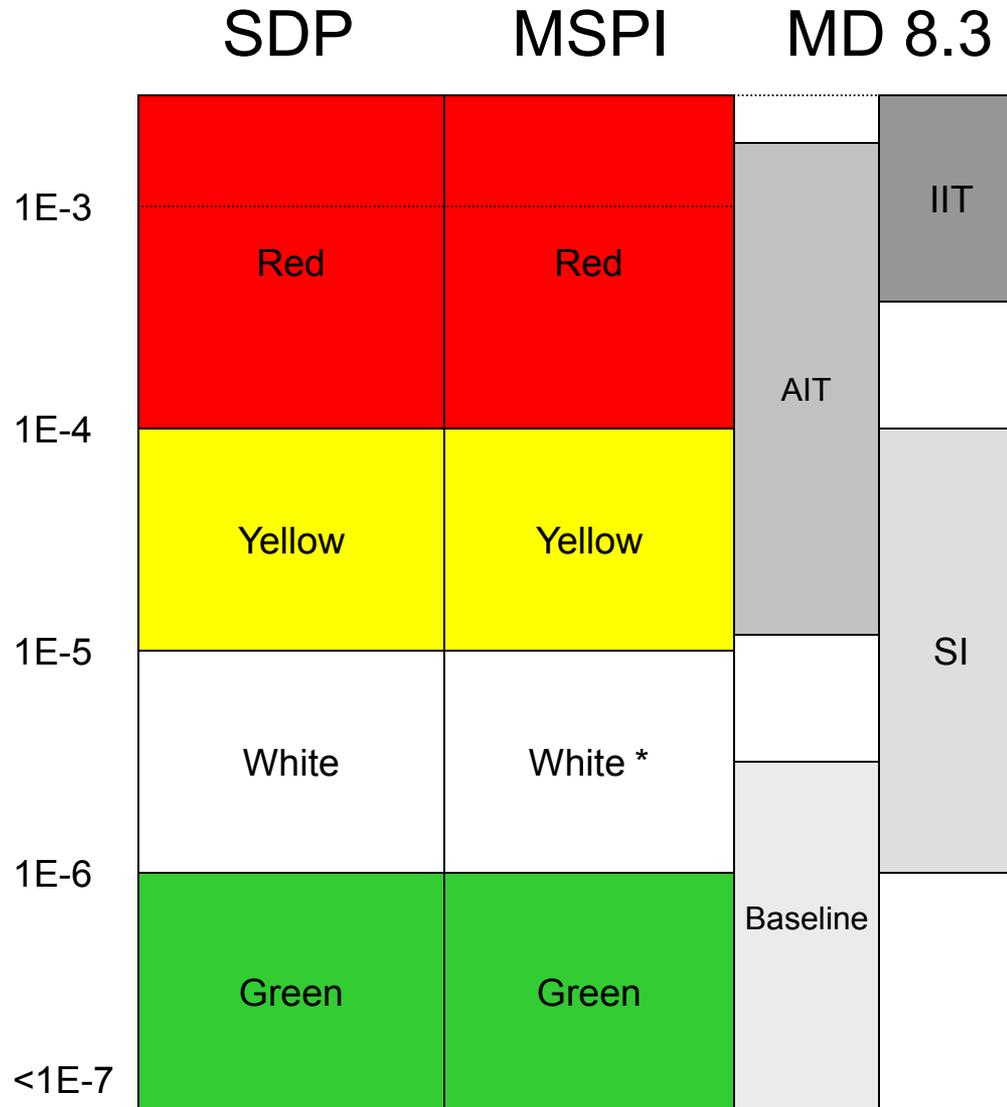
MSPI Guidance

- Implementation guidance in IMC 0608, “Performance Indicator Program,” and NEI 99-02, “Regulatory Assessment Performance Indicator Guideline”
- Covers five systems important to safety
- Tracks the availability of monitored trains and the reliability of monitored components
- Reflects the deviation of a specific unit’s performance from an industry baseline, converted to a simplified change in CDF
- A performance limit is also used for determining degraded performance

- Implementation guidance in MD 8.3, “NRC Incident Investigation Program,” and IMC 0309, “Reactive Inspection Decision Basis for Reactors”
- Reactive inspection thresholds are a function of conditional core damage probability and conditional large early release probability
- Overlap of options based on uncertainty and deterministic insights provides flexibility
- Additional deterministic criteria reviewed and documented as basis for staff decision in overlap region



ROP Risk-Informed Thresholds



ROP Tabletop Approach

- Tested various realistic scenarios to confirm the adequacy of the current ROP risk-informed processes for regulatory decision-making or identify areas for improvement
- Used a broad cross-section of well-vetted cases, developed from actual greater-than-green examples from the current fleet of reactors:
 - Significance Determination Process (SDP) findings
 - Mitigating Systems Performance Index (MSPI) data
 - Management Directive (MD) 8.3 event response
- Applied similar situations to the new reactor designs, filling in gaps with realistic hypothetical situations and reasonable assumptions, and then compared the risk values and resultant regulatory response

RESULTS

- Existing risk thresholds for determining significance of inspection findings are adequate
- Greater-than-green inspection findings would likely involve common cause failures and/or long exposures of risk-significant components
- Existing process does not always ensure an appropriate regulatory response for degradation of passive components and barriers

CONCLUSION

- SDP analyses could be augmented with additional qualitative considerations (deterministic backstops) to appropriately address performance issues

SDP Case Study Example

- Vessel head degradation resulted in a marginally white finding for the AP1000 and a green finding for US-APWR for LOCAs based on risk numbers
- Resultant regulatory response would be to move the AP1000 facility to Regulatory Response Column (column 2) of ROP Action Matrix and perform a 95001 supplemental inspection
- A more robust and diagnostic supplemental inspection (such as a 95002 or 95003) would better ensure root causes that led to the degradation are identified and corrected

Potential Deterministic Backstops

- Maintaining barrier integrity for fuel cladding, reactor coolant system pressure boundary, and containment
- Extensive equipment outage times resulting from degraded conditions (similar to the RITS 4b backstop completion time)
- Repetitive equipment failures that could degrade the reliability or availability of SSCs from performing their intended safety functions
- Designed to capture the infrequent yet potentially significant performance issues that would not otherwise be captured by the risk calculations to ensure an appropriate regulatory response

RESULTS

- Existing risk thresholds for invoking reactive inspections are adequate for new reactors
- Deterministic criteria used initially for event screening and then within a range of response determined by risk values
- Risk values heavily influence whether or not a reactive inspection is warranted and, if so, at what level
- Variations in or minor revisions to risk models used can potentially result in an inadequate response

CONCLUSION

- Contribution of existing deterministic criteria could be modified or new deterministic criteria developed for initiating reactive inspections

MD 8.3 Case Study Example

- For steam generator tube rupture at an AP1000 facility, the submitted Westinghouse PRA indicated only an SIT could be performed in accordance with the existing guidance
- The slightly more conservative SPAR model resulted in just crossing the threshold to consider an AIT
- An AIT would better ensure a broader and more comprehensive understanding and analysis of causes, conditions, and circumstances of event

RESULTS

- Existing MSPI is not adequate and would be largely ineffective in determining an appropriate regulatory response for active new reactor designs
- Meaningful MSPI may not even be possible for passive systems using the current formulation of the indicator
- Existing performance limit (backstop) could be further leveraged for active new reactor designs

CONCLUSION

- Alternate PIs in the mitigating systems cornerstone could be developed and/or additional inspection could be used to supplement insights currently gained through MSPI

MSPI Case Study Examples

- EPR emergency diesel generator (EDG)
 - > 25 EDG start failures or > 25 EDG run failures for the EPR to exceed the green-white threshold, - or –
 - 12 failures to reach performance limit
- US-APWR emergency feedwater pump (EFP)
 - > 14 turbine-driven EFP failures or > 25 motor-driven EFP failures for the US-APWR to exceed the green-white threshold, - or –
 - 6 failures to reach performance limit
- Current operating reactors: 2 to 5 EDG or EFP failures would typically result in white indicator



Draft Commission paper:

**Conclusions, options and recommendations
to the Commission**

Major Conclusions

- During the tabletop exercises for licensing applications, the staff did not identify any potentially significant decreases in the enhanced safety margins for new reactors
- Identified potential gap in the Tier 2 change process regarding severe accident features that are not related to ex-vessel severe accident prevention and mitigation
- Current risk thresholds are appropriate for ROP; however, a few changes to the ROP may be warranted consistent with the integrated risk-informed principles in RG 1.174

Specific Results

- **Risk-informed ISI: No gaps**
 - Risk-neutral effect for a new active plant and a new passive plant, even when sensitivity studies used more restrictive acceptance criteria
 - Numerous regulatory and programmatic controls (e.g., inspection of a minimum set of weld locations is required regardless of risk levels)
 - The 10 year ISI program is dynamic and allows for incorporation of lessons learned and update to risk ranking consistent with Part 52 requirements for PRA maintenance/upgrades

Results (cont.)

- **RITS 4b (completion times): Two key programmatic controls**
 - The risk-informed completion time is limited to a deterministic maximum of 30 days (referred to as the backstop completion time) from the time the TS action was first entered
 - Voluntary use of the risk-managed TS for a configuration which represents a loss of TS specified safety function, or inoperability of all required safety trains, is not permitted

Results (cont.)

- **RITS 4b staff exercises**
 - Staff identified some configurations of equipment outages that would represent 10 years' worth of core damage probability
 - Repeated entry into such condition over time could increase CDF by one or more orders of magnitude, which could approach the baseline CDF of currently operating plants
 - Staff believes these configurations are unlikely or unrealistic, and that there were additional regulatory and programmatic controls that would limit the aggregated risk increase (e.g., performance monitoring, periodic PRA maintenance and upgrade under 50.71(h))
- **Staff concludes no substantive changes to methodology is necessary**

Results (cont.)

- **Maintenance Rule 50.65 (a)(4): No gaps in assessment and management of risk**
 - When PRA approach is combined with other inputs such as the degree of defense in depth and plant transient assessment, factors other than PRA are often more limiting in terms of the risk management action level
 - NUMARC 93-01, Section 11 explicitly acknowledges “there is acknowledged variability in baseline core damage frequency and large early release frequency... determination of the appropriate quantitative risk management action thresholds are plant-unique activities”
 - Some changes to NUMARC 93-01 may be necessary to address changes of scope because of new and different SSCs in the new reactor designs

Results (cont.)

- **RITS 5b (surveillance frequency control program): No gaps**
 - Surveillance frequencies that are controlled by other programs are excluded from the SFCP
 - Equipment covered by inservice testing, for example major pumps and valves, tend to have some of the highest risk importances but are excluded
 - What remains to be implemented under RITS 5b generally are lower risk importance components
 - Unlike RITS 4b, RITS 5b is much more deterministically oriented, with risk impact only a secondary consideration in the criteria for changing surveillance test interval

Results (cont.)

- **50.69: No gaps**
 - Sample application to new reactor design (PWR with active safety systems) shows approximately same categorization distribution (RISC-1,2,3 & 4) as South Texas 1 & 2 pilot based on importance measures
 - Rule has built-in measures to monitor RISC-3 components and take corrective actions (e.g., periodic program review every 2 refuel cycles)

Results (cont.)

- **RG 1.174: No gaps**
 - In many of the examples during the exercise, the estimated change in core damage frequency (Δ CDF) was observed to be very low and well below Region II of the acceptance guideline per Figure 3 of RG 1.174
 - Degradation of defense in depth would be an area of close review by the staff
 - Changing a plant feature from highly passive to active thus placing greater reliance on key operator actions would be an area for close review by the staff
 - Proposed changes in or near the boundary of Region II would undergo close scrutiny by the staff, and there would need to be a compelling reason on the part of the license holder for the proposed change. Serious consideration of alternatives with lower risk impact would need to be assessed by the licensee

Results (cont.)

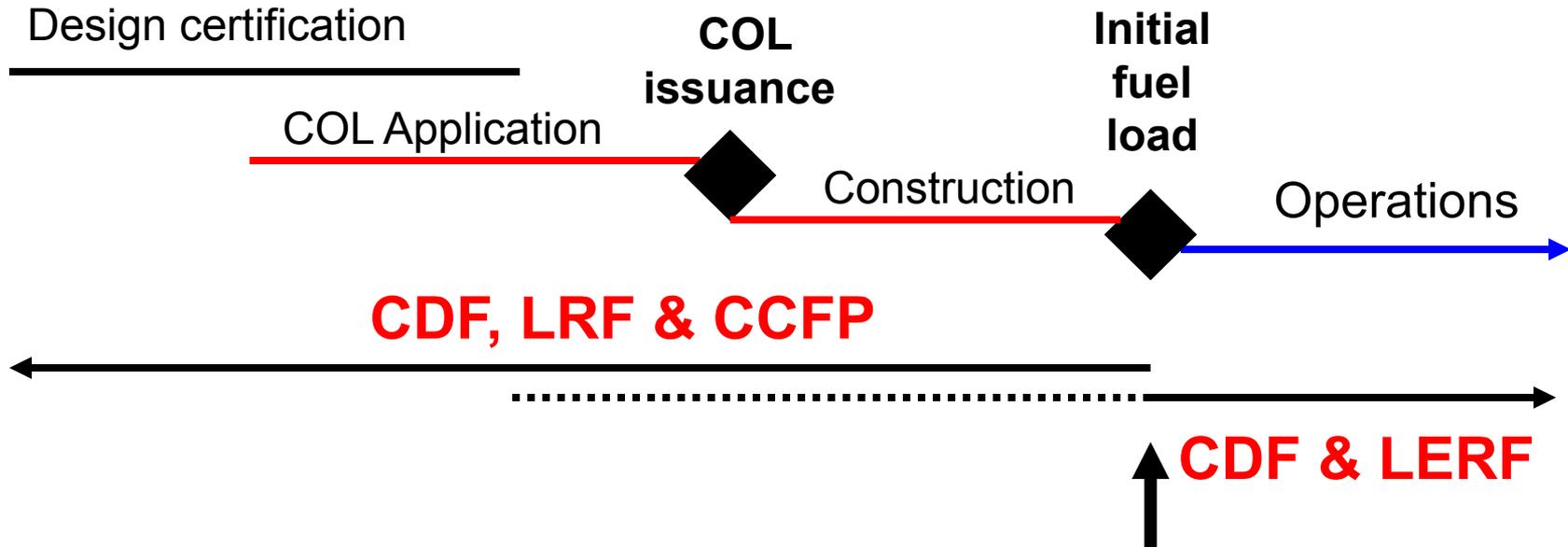
- **Part 52 50.59-like change process: Gap identified**
 - Staff generally satisfied with “ex-vessel” portion of NEI 96-07 Appendix C; staff comments incorporated
 - However, changes to severe accident design features that are not specifically intended to address EVSAs (e.g., containment bypass) are not addressed using severe accident criteria as in Section VIII.B.5.c.
- **Recommendation 1**

Address the potential gap, by a) ensuring that there are sufficient details on all key severe accident features in Tier 1, and b) including a change process in future design certification rulemakings in Section VIII for *non-ex-vessel severe accident features* similar to Section VIII.B.5.c for *ex-vessel severe accident features*

LRF-to-LERF Options

- **Option 2A: continue use of LRF (& CCFP) indefinitely**
- **Option 2B: continue use of LRF (& CCFP) indefinitely and add LERF at initial fuel load**
- **Option 2C: transition from LRF to LERF at or prior to initial fuel load; discontinue regulatory use of LRF (& CCFP) thereafter**

Option 2C



- LERF calculated at or prior to initial fuel load. CDF & LERF used for RG 1.174 acceptance guidelines going forward.
- Last regulatory use of LRF & CCFP

- **Recommendation 2**

Staff recommends Option 2C to harmonize risk-informed applications for the new reactors consistent with the risk metrics used by the currently operating fleet

Results (cont.)

- **Other programs not assessed in tabletops**
 - Risk-informed inservice testing of pumps and valves (RG 1.175)
 - Integrated leak rate testing interval extension (NEI 94-01)
 - 50.46a
 - NFPA 806
- **Little short-term interest by COL applicants**
- **Alternative source term (RG 1.183) implemented at all new designs with COLAs except ABWR**

Objectives for ROP Options

- Maintain current risk thresholds for new reactor designs
- Consistent with integrated risk-informed decision-making concepts in RG 1.174
- Afford greater operational flexibility based on enhanced safety margins

OPTION A: USE AS IS

- Use the existing risk-informed ROP tools for new reactor applications without making any changes
- No additional action or resources needed, but existing tools may not always provide for an appropriate regulatory response

OPTION B: AUGMENT EXISTING PROCESSES

- SDP: Use existing risk-informed SDP, but augment with deterministic backstops to ensure an appropriate regulatory response to address performance issues
- MD 8.3: Modify the contribution of existing deterministic criteria or develop new criteria for determining the appropriate regulatory response to plant events
- MSPI: Develop alternative to MSPI or augment existing guidance to emphasize performance limit for active new reactor designs, and increase inspection of passive mitigating systems for passive new reactor designs
- Proposed enhancements could be developed using existing resources and working with stakeholders

OPTION C: DEVELOP DETERMINISTIC TOOLS

- Do not use the existing risk-informed ROP tools
- Capture risk insights to a lesser extent than the current fleet using deterministic guidance consistent with new reactor design certification and licensing basis
- Additional resources may be necessary to research and develop the new guidance documents

Staff Recommendation: Option B

Augment Existing Processes

- Staff would obtain Commission approval for proposed changes to ROP at least one year prior to implementation
- Process enhancements could be further refined based on experience and lessons learned

Next steps

- **Full ACRS April 12**
- **Finalize Commission paper based on ACRS and stakeholder feedback**
- **SECY due to be issued early June, 2012**

New Plant Risk Framework

ACRS PRASC
March 7, 2012

Biff Bradley
reb@nei.org



NUCLEAR
ENERGY
INSTITUTE

Risk-Informed Applications for New Plants

- **New plants have PRA requirements under 10 CFR 50.71**
- **New plants have safer designs benefiting from PRA insights**
- **New plants should be encouraged to use available risk-informed applications**

Risk-Informed Applications for New Plants

- **Significant voluntary risk-informed regulatory applications are available for operating plants**
 - **Technical Specifications, Inservice Inspection, Risk-Informed scope for special treatment regulations**
- **Mandatory risk uses include maintenance rule, reactor oversight process**

NRC Tabletop Exercises

- **Consistent with Commission directive**
- **Well organized**
- **Good participation from NRC staff and industry**
- **Examples were realistically constrained while still testing guidance**
- **Industry in general agreement with NRC findings in draft SECY**

Industry Observations

- **Agree with NRC conclusions relative to licensing applications**
- **Agree that elements of existing reactor oversight process will need to be replaced or rethought for new plants**
 - **Details of additional qualitative considerations are important**

Industry Observations

- **Agree that there is a potential gap in change process considerations for new plants with respect to “other than ex vessel” severe accident mitigation features**
- **This gap has been addressed in practice thus far, and can be dealt with through Tier 1 descriptions in future DCRs**

Conclusions

- **Thorough effort to address gaps in guidance, and responsive to Commission direction**
- **Industry supportive of conclusions**
- **We look forward to implementing risk-informed applications and supporting dialogue on revised ROP considerations and any necessary enhancements to change control guidance**