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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

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TUESDAY

JUNE 19, 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 1:00 a.m., John
Stetkar, Chairman, presiding.

SUBCOMMITTEE MEMBERS PRESENT:

JOHN W. STETKAR, Chairman

DENNIS C. BLEY

MICHAEL T. RYAN

STEPHEN P. SCHULTZ

WILLIAM J. SHACK

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NRC STAFF PRESENT:

JOHN LAI, Designated Federal Official

GARY DEMOSS

MARY DROUIN

STEPHEN DINSMORE

ANDERS GILBERTSON

ALSO PRESENT:

JOHN LEHNER

JEFF LaCHANCE

TIM WHEELER

MARY PRESLEY

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

(12:59 a.m.)

CHAIR STETKAR: The meeting will now come to order. This is a meeting of the Reliability and PRA Subcommittee. I'm John Stetkar, Chairman of the Subcommittee meeting. ACRS member in attendance are, Steve Schultz, Dennis Bley will join us, Bill Shack and Mike Ryan. John Lai of the ACRS Staff is the designated federal official for this meeting.

The Subcommittee will hear the staff's discussion of the revised NUREG-1855 Guidance on the Treatment of Uncertainties Associated with PRAs and Risk-Informed Decision Making. We'll hear presentations from the NRC staff, their contractors and a representative from EPRI. 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 discussion.

We have received no written comments or requests for time to make oral statements from members of the public regarding today's meeting. The entire meeting will be open to public attendance.

The Subcommittee will gather information, analyze relevant issues and facts and formulate proposed positions and actions, as appropriate, for

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1 bill deliberation by the full Committee. The rules
2 for participation in today's meeting have been
3 announced as part of the notice of this meeting
4 previously published in the Federal Register. The
5 transcript of the meeting is being kept and will be
6 made available as stated in the Federal Register
7 Notice.

8 Therefore, we request the participants in
9 this meeting use the microphones located throughout
10 the meeting room when addressing the Subcommittee.
11 The participants should first identify themselves and
12 speak with sufficient clarity and volume so that they
13 may be readily heard.

14 We will now proceed with the meeting. And
15 I call upon Gary DeMoss of Research to begin.

16 MR. DEMOSS: Hello. I'm Gary DeMoss, the
17 Performance and Reliability Branch Chief in the
18 Division of Risk Assessment and Office of Research.
19 I want to thank this team for pulling together NUREG-
20 1855, this revision of it, and the presentation today.
21 I think they've done an outstanding job and I the ACRS
22 should have little trouble wearing them down because
23 this hard-working group did a two-hour public meeting
24 on another topic this morning.

25 The document's an important revisions to

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1 NUREG-1855, I characterize the initial revision as a
2 lot great information not structured in a fully
3 useable manner. Well they've restructured this
4 information and expanded the scope. And I think
5 they'll present you an outstanding piece of work.
6 Mary.

7 MS. DROUIN: Thank you, Gary. Okay,
8 before we get started I would like to acknowledge the
9 team, because the team really has worked, of course
10 very hard on the first revision. But, as you will see
11 as we go through, we have really done a major
12 restructure of this document. And I think done a vast
13 improvement in terms of its usability to the
14 stakeholders, both internal and external to the NRC.

15 So sitting over on the table there is
16 Anders Gilbertson from Research. Steve Dinsmore is
17 somewhere around here, there he is. Steven Dinsmore
18 and others from NRR, we had quite a few interactions
19 with them to the best way to restructure the document.
20 So Andy Howe, who is now retired, was a major player.
21 And Donnie Harrison, who apologizes that he couldn't
22 be here today.

23 John Lehner, to my right, from Los Alamos
24 and Jeff -- Sorry. That was my big mistake for the
25 day. From Brookhaven. And Jeff LaChance and Tim

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1 Wheeler from Sandia National Lab.

2 Okay. So today we're going to try and
3 concentrate on the changes but we felt that it had
4 been such a long time since we'd been here to visit
5 the Committee that we thought it was important to go
6 through, briefly, the background, the objective, the
7 scope. We're really focusing on what the NUREG
8 structure is, the overall approach and the detailed
9 guidance. Appendix A, which is the test case, and
10 then let you know where we plan to go forward.

11 Okay, how did this project come to be?
12 Well it really was a result from two letters that were
13 from the ACRS asking the staff to look into the
14 treatment of uncertainties. How to define bounding
15 analysis and just what do you do with uncertainties in
16 your risk decision making process.

17 So we came up with the document. And when
18 we came back to the ACRS, back in February, they did
19 support publication of the NUREG but at the time --

20 CHAIR STETKAR: February of 2009, for the
21 record.

22 MS. DROUIN: Yes. But they did not
23 believe that publication of Appendix A should occur.
24 And the reason for that is, though they liked Appendix
25 A, they felt like it didn't have enough cautionary

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1 statements in it. That it would be very easy for a
2 licensee to adopt it as something absolute versus an
3 illustration. So we had agreed that we would add
4 those cautionary statements.

5 It was first issued for a draft in 2007
6 for public review and comment. And then for use in
7 2009. And, as I said, Appendix A has actually never
8 been formally published. We met again with ACRS in
9 March of 2009 and we did go through the changes to the
10 Appendix and they agreed with them. But they wanted
11 us to come back after our public workshop and share
12 what we had learned. And that meeting, which is
13 actually today's meeting, has been deferred each year.
14 And I think other events have now overtaken it.

15 But the public workshop was very
16 important. It was a two and a half day workshop and
17 we got a lot of tremendous insights from it. And
18 Appendix A was made public. It wasn't published as
19 part of the NUREG, but it was made public and so we
20 did get a lot of good information on the usefulness of
21 the Appendix.

22 And the major comment that we got, from
23 both our stakeholders and internal, was that this was
24 a great document. It had a lot of interesting
25 information in there. But it was written more kind of

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1 like an intellectual document and not so much as
2 guidance. You know, what do I do with this
3 information, you know, you've given me cautions. And
4 you need to consider this and you need to consider
5 that, but how do I actually, you know, what do I
6 really do with all this information.

7 So based on that we spent quite a bit of
8 time on trying to figure out how to restructure the
9 document to make it useful and not just an academic
10 type of exercise. At the same time that was happening
11 we did receive some user need requests from NRR and
12 NRO saying please expand the scope to include internal
13 fire, seismic Level 2 and low-power shutdown.

14 Now, expanding that part really did not
15 effect our document, because our document is more the
16 process and the process was already kind of generic.
17 So it really effected what EPRI was doing. And this
18 was, well here, let's go to the next slide.

19 We've been working with EPRI under an MOU.
20 When the work first started it was discovered that
21 both NRC and EPRI was doing something in this area.
22 So we thought it would be much more efficient if we
23 worked together and in some sense divvy up the work.
24 So there's the NRC Report, which is an NRC NUREG, and
25 then there is the EPRI Report. And they compliment

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1 each other, they do not overlap in the sense that they
2 aren't redundant.

3 MEMBER BLEY: They haven't updated that
4 since 2008 version, have they?

5 MS. DROUIN: No, but you're going to hear
6 from Mary on what's happening with the EPRI document.

7 MEMBER BLEY: Okay, good.

8 CHAIR STETKAR: Mary, although you
9 characterize them as complimenting one another the
10 NUREG refers directly to table numbers, to section
11 numbers, to analyses in that EPRI report. I'm curious
12 because they're so intertwined, or at last reading the
13 NUREG looking toward the EPRI document. Why wasn't
14 this NUREG issued as a joint EPRI staff NUREG as other
15 NUREGs have been done under kind of similar close
16 cooperation?

17 MS. DROUIN: Well because we felt we could
18 really divvy it up. And that we weren't going to be
19 held to each other. We had our report and industry
20 had their report. And we felt like we could define
21 pieces of work where we could each go off and do our
22 piece. Now that doesn't mean that we worked
23 independent of each other. EPRI was very much
24 involved in reviewing what we did and gave us
25 comments. We would look at what they did and gave

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1 them comments. But we really felt that this was a
2 much more efficient way to go.

3 CHAIR STETKAR: Let me then ask you, since
4 this is only a NUREG, it's not a regulatory guide or
5 the SRP. It does mention at least three ISGs that are
6 in progress. I think I counted three, I'm not sure if
7 there's --

8 MS. DROUIN: Yes, I think that might be
9 right.

10 CHAIR STETKAR: I don't know if they're
11 three separate ones, since they're just refereed to as
12 an ISG in progress. When they are issued or
13 regulatory guides or part of the standard review plan
14 is updated how will you address potential deviations
15 between this NUREG and the EPRI report? Will there be
16 separate endorsements for each report.

17 I'm concerned about making references to
18 Table A point something or other in the EPRI report as
19 a basis for an analysis that was done, that's used now
20 in this NUREG, which maybe endorsed in a Regulatory
21 Guide and then the EPRI report deviating at some time
22 in the future from this NUREG and somehow being
23 endorsed as NRC accepted methods. So have you thought
24 how will that all work itself out if it's not a single
25 joint report?

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1 MS. DROUIN: Because that's part of the
2 MOU process. I mean, this is work we're doing
3 together.

4 CHAIR STETKAR: No, I understand that.
5 But in a regulatory sense when the staff now reviews
6 a license application that makes use of the guidance
7 and methods in this NUREG, or according to some
8 Regulatory Guide. When the staff does that review how
9 do they treat these references to an EPRI report, as
10 examples of kind of how to do it? Not the overriding
11 what ought to be done, but how it's done.

12 MS. DROUIN: Well their report is
13 endorsed, our report. Now we have just tried to help
14 out the reader and point them to particular places in
15 the EPRI report.

16 CHAIR STETKAR: I understand that.

17 MS. DROUIN: But, you know, we have in
18 essence endorsed their report in our report.

19 CHAIR STETKAR: So will that endorsement
20 of both reports, I mean, it doesn't say anywhere this
21 report endorses the analyses in the EPRI Report --

22 MS. DROUIN: And we can clarify that.

23 CHAIR STETKAR: -- to support regulatory
24 decision making.

25 MS. DROUIN: We can clarify that.

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1 CHAIR STETKAR: I mean what I'm concerned
2 about is they may be completely dovetailed right at
3 the moment because you've been working closely
4 together. The NUREG, you know, NUREGs take on a life
5 of their own. They're updated at some periodicity
6 approaching geologic timeframes in some sense.

7 But there will be guidance to staff
8 reviewers on how to assess a submittal in terms of the
9 scope and the quality of uncertainty analyses that are
10 provided in that submittal.

11 And in fact the NUREG, Stage G, as you get
12 to it talks about a bit of that process. But if EPRI
13 updates their document in a year and a half after
14 running through some more actual licensee submittals
15 and decides that oh, gee, this particular approach
16 doesn't seem to work. We'll change our guidance. How
17 does that work into a regulatory review process?

18 MS. DROUIN: Well we would have to make a
19 decision. Now if they decide to update their report
20 that report's not endorsed. I mean there is a report
21 that has a certain number and date within --

22 CHAIR STETKAR: It doesn't yet.

23 MS. DROUIN: Well, now if they go and
24 update their report we will have to make the decision
25 of do we modify the NUREG or do we issue perhaps an

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1 ISG that, you know, there's many different ways to
2 handle it.

3 CHAIR STETKAR: Okay, well.

4 MEMBER SCHULTZ: So you have in mind a
5 particular configuration control for the
6 documentation. But as John says, the process going
7 forward could become complex.

8 CHAIR STETKAR: It could.

9 MEMBER SCHULTZ: And that's why I mean you
10 have to --

11 CHAIR STETKAR: I mean other NUREGs have
12 been issued as a joint report to sort of freeze, you
13 know essentially freeze that endorsement.

14 MS. DROUIN: Well it is frozen in the
15 sense that it is a specific report we endorse. I mean
16 it's no different than any other industry document out
17 there. We endorse documents all the time. And then
18 they go and change over time and we have to decide
19 whether or not we're going to update to endorse their
20 changed document.

21 MEMBER BLEY: So what we've seen
22 elsewhere, in a case like this, is you endorse a
23 specific version of their report?

24 MS. DROUIN: Yes. Yes.

25 MEMBER BLEY: And then if there's a new

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1 one and you want to endorse that you have to update
2 your NUREG?

3 MS. DROUIN: I mean we might update the
4 NUREG or there may be another way that we do it. I
5 mean, we do have options of how we would address a new
6 or a revised version.

7 CHAIR STETKAR: I'm assuming the NUREG,
8 this is being issued for public comment now or this is
9 being issued final? Rev 1?

10 MS. DROUIN: No, right now it's been
11 issued for internal review.

12 CHAIR STETKAR: Internal review. Okay,
13 that helps a little bit because there's still some
14 uncertainty about which version of the still in
15 progress update to the EPRI Report. In some places it
16 referred to the 2008 version of the report but that's
17 obviously going to change, I would think, sometime in
18 the near future.

19 MS. DROUIN: Right. And that's where we
20 have to coordinate closely, because we can't legally
21 reference something that hasn't been published yet.

22 CHAIR STETKAR: That's right.

23 MS. DROUIN: We can footnote it but we
24 can't do a legal reference.

25 CHAIR STETKAR: Right.

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1 MS. DROUIN: So right now it's footnoted
2 and our timeframe is such that, you know, they'll have
3 their document out before we go final on ours.

4 CHAIR STETKAR: Okay, thanks. That helps.

5 MS. DROUIN: Okay. Along with that, this
6 is how the two documents, is that ours is providing
7 the process for how you treat the uncertainties. And
8 the EPRI report is primarily two things. It's giving
9 the guidance on how to do the state-of-knowledge
10 correlation and then it's identifying two things. A
11 generic source of model uncertainties and how you go
12 about identifying unique ones. And Mary will talk to
13 you about the EPRI report.

14 Okay. So now let's get into how this
15 document was restructured. It was organized around
16 three parts. And these three parts were divvied up
17 into seven stages. And the first part was determining
18 whether or not your risk-informed decision, or your
19 risk-informed activity or application is, when you're
20 dealing with the uncertainties do you use the process
21 in this document? Because this document doesn't care
22 how you treat uncertainties everywhere.

23 And then Stages B through F is giving the
24 guidance for the licensee. This is what we expect the
25 licensee to do. And then Stage G is discussing,

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1 describing the process used by the staff to see if
2 what they did was appropriate. So we're going to go
3 through --

4 CHAIR STETKAR: Okay, who's hitting the
5 microphone?

6 (Simultaneous speaking.)

7 MS. DROUIN: Okay, I'm just going to
8 quickly describe each of these stages and then we're
9 going to go through in detail and explain to you the
10 stages. But basically when you look at Stage A that
11 is to determine whether the NUREG is applicable to the
12 decision. There's --

13 CHAIR STETKAR: Mary, before we get into
14 the stages, I'm sorry, I was writing things. And I
15 think it's appropriate to ask now. As I read this,
16 and I probably missed it in an earlier vision of the
17 NUREG. The NUREG, I think, specifically says it
18 applies to licensee submittals in support of risk-
19 informed applications.

20 And it also seems to explicitly exclude
21 the NRC staff from doing any of these types of
22 uncertainty analyses in any of the decisions they
23 make. For example, in terms of -- I can pull up the
24 section with the quote in it. In terms of
25 significance-determination process and reactor

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1 oversight. In terms of notice of enforcement
2 discretion and other applications. And I was curious
3 why the industry is held to a different standard than
4 the staff in terms of assessments or --

5 MS. DROUIN: Hopefully when we go through
6 Stage A we will make that clear.

7 CHAIR STETKAR: Okay. All right, I'll let
8 you go through Stage A.

9 MS. DROUIN: We did have criteria for
10 where this is applied and where it isn't. You know I
11 truly apologize, I thought I had turned it off.

12 CHAIR STETKAR: If you'll address that in
13 Stage A, I'll wait.

14 MS. DROUIN: Yes, we're going to go
15 through each of these.

16 CHAIR STETKAR: Okay.

17 MS. DROUIN: So in Stage A we recognize
18 that you always have to deal with your uncertainties.
19 But do you apply this process? And there are
20 situations where this would not be the process. And
21 we tried to identify what circumstances would this not
22 work with.

23 Then Part 2, which is Stages B through F
24 is that's guidance for the licensee or the applicant.
25 Now you're going to hear us say licensee all the time

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1 but when we say licensee we always mean the applicant,
2 which is a new reactor, because they're not a licensee
3 yet, they're an applicant.

4 So for Stage B that is making the decision
5 whether or not given the decision you have underhand,
6 whether the PRA that you're using has the right scope
7 and level of detail. So it's giving the guidance and
8 the criteria for making that determination.

9 And then Stage C is that, coming out of
10 Stage B you're going to end up having three answers.
11 Either the PRA is of sufficient scope. It's not of
12 sufficient scope but you're going to refine your
13 application to make it of sufficient scope. Or maybe
14 you might try and do some kind of bounding analysis or
15 some kind of sensitivity to show you don't have to
16 consider that.

17 Well that's part of the completeness. So
18 the criteria and the steps you have to go through is
19 what is in Stage D, sorry Stage C. And then Stage D
20 is that okay, now you have your PRA and you have the
21 results and you're looking at the parameters, so
22 you're looking at your values out of your PRA against
23 your acceptance guidelines. And what are the
24 uncertainties associated with that in determining
25 whether or not you challenge or you meet or exceed

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1 your acceptance guidelines.

2 And then Stage E is then looking at the
3 model uncertainties. You know, how do you go about
4 identifying the key model uncertainties and what you
5 do with them in your decision making.

6 And then Stage F, now all of these stages
7 so far, B, C, D and E were in there, but we cut and
8 pasted them in a more logical fashion. Now Stage F is
9 actually a new chapter. And this is coming in, we
10 recognize that this is really an iterative process,
11 you don't do these things sequentially.

12 And so the licensee is always going to be
13 thinking, you know, what is his strategy. You know,
14 does he update the PRA. Does he do some kind of
15 bounding? What does he do when he starts challenging
16 the acceptance guidelines, should he do compensatory
17 measures? Should he do monitoring.

18 So Stage F is to provide some guidance to
19 the licensee in helping them develop their strategy
20 for what they're going to put in their submittal. And
21 you'll see a lot of parallel between Stage F and Stage
22 G because that's giving the staff process. So there
23 should be a lot of parallel between those two
24 chapters.

25 So then Stage G is providing the process

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1 the staff uses. This one's a little bit different in
2 that it's not written, you know, we don't say this
3 provides guidance to the staff. This is telling the
4 licensee what the staff does. So it's explaining the
5 process versus giving the guidance thing to the staff,
6 because that's in standard review plans and elsewhere.

7 Okay. This is just a figure, you'll see
8 it in the NUREG. That's just trying to show all of
9 these stages and to communicate that this is a very
10 iterative process. And that we will get into, when
11 you get into Stage G, whether or not you meet the risk
12 element of your risk-informed decision making process
13 or whether the application would be rejected.

14 Also feeding into there, and we'll get
15 into that in a little bit, is you have to have an
16 understanding of the risk-informed decision making
17 process to truly understand the NUREG.

18 And you need to understand the ASME/ANS
19 standard, because this document is also providing you
20 how you meet certain requirement in the standard, at
21 least from an NRC perspective. You know, how we
22 expect those, because the standard just tells you you
23 need to identify your uncertainties and you need to
24 characterize them. It doesn't tell you how you go
25 about doing that. So this document is providing that

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1 how-to part.

2 Okay. So getting into this overall
3 approach, the licensee needs to have a clear
4 understanding of several things. The application and
5 the risk contributors, the uncertainties, particularly
6 in the context of the decision under consideration.
7 And what is the impact of these uncertainties relative
8 to your acceptance guidelines. And then what are the
9 requirements in the standard as endorsed by the NRC.

10 And this is where you'll see some of the
11 ISGs, because right now we're not revising Reg Guide
12 1.200 but we have some problems with some of the stuff
13 in the standard that would impact this document. So
14 in order to complete this document and to give
15 licensees an understanding of our position there are
16 some ISGs that are being written.

17 CHAIR STETKAR: What's the schedule for
18 those ISGs?

19 MS. DROUIN: Those are going to be done
20 this year.

21 CHAIR STETKAR: This year?

22 MS. DROUIN: This year.

23 CHAIR STETKAR: We should see that.

24 MR. LAI: Okay.

25 MS. DROUIN: So I don't think we have to

1 spend a lot of time. There's the three types of
2 uncertainties. The completeness, the parameter
3 uncertainties and the model uncertainties. I think
4 we've spent a lot of time with that in the past.

5 Okay. The PRA standards requirement.
6 When you're looking at the parameter uncertainties the
7 standard, as endorsed by the NRC, and this will be
8 reflected in the ISG, is that depending on the
9 significance of the basic event mean values or point
10 estimates are acceptable with characterizing
11 uncertainty either qualitatively or with a
12 probabilistic representation.

13 And then depending on the significance of
14 the sequences and the significance of the state-of-
15 knowledge correlation, mean values or point estimates
16 of the risk metrics are acceptable with an estimate of
17 the uncertainty interval or with propagating the
18 uncertainty distribution.

19 MEMBER SHACK: Now this notion of the
20 significance on the Category 2 thing, I couldn't find
21 that in the standard. That seemed to me something
22 that you put into the NUREG as your interpretation of
23 the way --

24 MS. DROUIN: No, it's very clear and I'll
25 send you an email showing you where that is in the

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1 standard.

2 MEMBER SHACK: Okay. I looked and I
3 couldn't find it.

4 MR. LEHNER: I'll talk a little bit about
5 that in my stage.

6 MS. DROUIN: Oh that's right. It's QU-E3,
7 QU-A1. But he does get into it in his presentation.

8 MEMBER SHACK: Okay, I looked and I didn't
9 find it, but I'll wait.

10 MS. DROUIN: Well we can point you
11 directly to which supporting requirements it is.

12 MR. LEHNER: Although the reporting
13 requirements in the current version of the standard
14 may not read exactly like --

15 MS. DROUIN: But that's okay, it hasn't
16 changed from the current.

17 MR. LEHNER: Okay.

18 MS. DROUIN: Then for mono uncertainties
19 the standard as endorsed by the NRC is that you need
20 to identify your sources of uncertainty and
21 characterize them. You know, understanding what their
22 impact would be. Are they going to introduce a new
23 initiating event? Are they going to change the
24 success criteria? Do you get a new accident sequence?

25 Now this is the definition that is used in

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1 the standard that we have adopted in the NUREG. And
2 I will have to say every time I read it I personally
3 have problems with it. So this is going to come as a
4 surprise to my colleagues. But it finally dawned on
5 me what I had problems with and it is when it says, "A
6 source of model uncertainty exists when a credible
7 assumption is made." And it's the word credible
8 because un-credible assumptions. Does that mean if
9 it's un-credible it's not a source of uncertainty?

10 CHAIR STETKAR: I hope in your wonderful
11 NUREG on definitions of terms you're going to have a
12 clear definition of what credible is?

13 MS. DROUIN: That's a very good comment.

14 CHAIR STETKAR: No, honest that's not a
15 snide remark. People throw that word around just
16 wildly and --

17 MS. DROUIN: But I know that we have --

18 CHAIR STETKAR: Just because something is
19 rare doesn't mean it's incredible, it's just rare.

20 MEMBER SHACK: There is a sentence there
21 that defines a credible assumption.

22 MS. DROUIN: See and I wonder, that makes
23 it seem --

24 CHAIR STETKAR: Okay, what is broad then?
25 I'm a broad person, but it doesn't necessarily mean

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1 that --

2 MEMBER SHACK: In a relevant technical
3 community?

4 CHAIR STETKAR: There are a lot of terms
5 in the standard, as you're well aware of, as you've
6 mentioned, that leave a lot to be desired.

7 MS. DROUIN: Yes. But I come back to when
8 we think of a source of model uncertainty, you know,
9 when a credible assumption, and even though it has
10 sound technical basis, it may not have sound technical
11 basis and it's still a source of model uncertainty.
12 So I think that this definition still needs some work,
13 personally. And I would love to see the ACRS weigh in
14 on this.

15 CHAIR STETKAR: Well unfortunately we,
16 well I guess we can weigh in on it in terms of how
17 it's used in this NUREG.

18 MS. DROUIN: Yes.

19 CHAIR STETKAR: We can't say anything
20 about the standard.

21 MS. DROUIN: No, no, no. Here. Okay. I
22 won't spend really hardly any time on this risk-
23 informed decision making process. In creating the
24 NUREG and knowing how it all fits together you need to
25 understand what is this process and it has these

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1 principles that are defined but the principles in and
2 of themselves do not explain the decision making
3 process.

4 So in looking at the NUREG and the
5 guidance we're centered around Principle 4. But some
6 of these others come in to play when you create your
7 strategy for dealing with the uncertainties. And
8 that's reflected here. And when you go through and we
9 talk about Stage A is determining whether it's
10 applicable. B is looking at whether the scope or
11 level of detail match up, et cetera.

12 It does follow this process that the NRC
13 came up with when it first published Reg Guide 1.174
14 in defining the decision, identifying your applicable
15 requirements, et cetera.

16 CHAIR STETKAR: One of the things, Mary,
17 and this is kind of, for me anyway, a fairly important
18 philosophical issue. This drawing in the NUREG draws
19 a nice, clean dotted line around what the NUREG
20 addresses. And it shows that little excerpt from
21 deterministic analyses as assessing the impact on
22 defense-in-depth and safety margins.

23 If you read the words in the NUREG, and
24 maybe I'm misinterpreting them, it seems to say, well
25 we aren't interested in uncertainty analysis to

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1 address safety margins, because that's strictly a
2 deterministic evaluation. And that's reinforced by
3 this picture here, it's outside the dotted line.

4 There's a drawing that's similar to this
5 in Reg Guide 1.174 that doesn't show this crisp dotted
6 line, and indeed it shows direct crosstalk between
7 deterministic analyses for safety margins and PRA
8 analyses. So the NUREG has separated that out. And
9 that's different. And that's an important difference
10 for me.

11 I use the example of if I go to my
12 financial advisor with the \$10.63 that I have left in
13 my IRA and say, gee, financial advisor, what's going
14 on in the world of investments this year? And the
15 financial advisor, as they always do, says oh the rate
16 of growth is going to be a little bit slower than we
17 expected it to be last year. Well that gives me one
18 piece of information.

19 If the financial advisor tells me, gee,
20 the chance of you losing 40 percent of your net worth
21 has increased from three percent to 15 percent, that
22 tells me a little bit different information about my
23 margin and I might make a much different decision
24 about my investment portfolio with that than his
25 expectation that the rate of growth might be a little

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1 bit slower than it was last year.

2 So this notion of assessing the
3 probabilities and looking at where our uncertainty
4 brings us with respect to the margins, I think is an
5 important part of this decision process. And in fact
6 there's an example in, I lose track of whether it's in
7 the appendix or in the text. It says well the 95th
8 percentile of the analysis might show that we could be
9 in Region II, let's say, rather than Region I but we
10 don't care about because the mean value is in Region
11 I.

12 And that bothers me a little bit. Is that
13 consistent with NRC understanding of the use of
14 uncertainties in Decision making and to understand
15 where you are relative to acceptance margins?

16 MS. DROUIN: Yes.

17 CHAIR STETKAR: It is? All right.

18 MS. DROUIN: Because when you go back and
19 use 1.174 as an example here the staff made it very
20 clear that we're looking at the main value against
21 quantitative acceptance guidelines. And you've
22 treated your parameter uncertainties by using a mean
23 value. Now you have to show, you have to factor in
24 this state-of-knowledge correlation. But that's
25 completely within keeping of the NRC position on

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1 1.174. Now whether or not, you know, revise 1.174,
2 that's totally different. Rather than keeping 1.174
3 --

4 CHAIR STETKAR: I've read 1.174 and it
5 certainly talks about mean values. It also talks
6 about assessments of uncertainties and having
7 confidence about where you are relative to margins.
8 It doesn't do it quantitatively, but it's --

9 MS. DROUIN: That's right.

10 CHAIR STETKAR: -- but it seems to be part
11 of the philosophy of it. And this, as I said, this
12 particular drawing draws a very clear distinction that
13 isn't drawn in 1.174. You know, it just isn't.

14 MS. DROUIN: Okay. Stage A. As we said
15 earlier, not every risk-informed decision that is made
16 should or can implement the process described in this
17 NUREG. And the approach to address uncertainties can
18 certainly vary depending on the nature of the risk-
19 informed activity under consideration.

20 So the way that we went about trying to
21 give guidance on whether or not to use this process is
22 divvied on two steps, is looking at the type of risk
23 results used in the application and are the results
24 PRA or non-PRA in nature. Because sometimes the risk
25 results might have been derived qualitatively. And if

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1 the results are from a PRA are the results being used
2 to support the decision. Sometimes they're a minor
3 factor in the decision so they aren't playing a big
4 role in the decision that's being made.

5 So in looking at --

6 MEMBER BLEY: I haven't thought about this
7 a lot, but there's a lot of very good guidance in how
8 to think about uncertainty, how to categorize it, that
9 to me applies no matter what kind of an approach
10 you're using. And to suggest a hard and fast rule
11 that it only applies to cases that are kind of fully
12 quantitative seems unfortunate. Because other people
13 could gain a lot from using this even in a qualitative
14 analysis.

15 MS. DROUIN: And, I agree with you and I
16 thought about that the other day when we were working
17 on our viewgraphs and everything, is that there is a
18 lot to be learned and that could be extrapolated.

19 MEMBER BLEY: And even, once you go
20 through that process of identifying and categorizing
21 the uncertainties then qualitatively it gives you a
22 different picture of the concept you're dealing with,
23 whatever the analysis is.

24 MS. DROUIN: So I don't know how, I mean
25 we'd have to give it some thought about how we would

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1 fix the text to let people know this. It wasn't meant
2 to be this hard and fast rule. And I mean if we just,
3 let's go here to the example to show. You know for
4 example the risk, if we look at the Maintenance Rule
5 (a)(2). It's utilizing a risk monitor, so you're
6 constantly evaluating the risk.

7 That would make it very hard to use this
8 kind of process. Now it's not some things in here you
9 wouldn't want to think about. You know, the risk is
10 constantly being evaluated. And it's not evaluated to
11 support an initiative. It's not evaluated as the
12 result of an event.

13 Whereas, when you look at the tech specs
14 it's utilizing a PRA, it's not continuous evaluated,
15 it's not as a result of an event. So it clearly is
16 subject to 1855. When we say it's not subject to 1855
17 we are not trying to say that there's not value in you
18 understanding what's in this document. But you're not
19 going to go through this prescriptive guidance that
20 we've sort of gone to now in this revision.

21 MEMBER BLEY: Yes, I see the place we've
22 worked ourselves into with having this kind of
23 guidance. It doesn't come out hard and fast, it's
24 like you don't have to think about this at all if
25 you're on the right side of your chart.

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1 MS. DROUIN: And there's probably some
2 stuff we could do in this chapter to soften that up
3 quite a bit.

4 MEMBER BLEY: It just seems a shame to me
5 to, it then demands another document that talks about
6 these other things. So if there was a way to deal
7 with that I think it would be really useful. Because
8 to me we're real close to having something here, not
9 the step-by-step what you do, but the general process.
10 Having something here that every decision going
11 throughout the agency ought to be thinking about these
12 concepts as it comes up. And right now there is
13 nothing like that to point to.

14 MS. DROUIN: I agree in that when you look
15 at across the Agency, when I mean that all the
16 different kinds of decisions that we do is part of our
17 regulatory job. And you going to always have to think
18 about uncertainties that, at a global level, these are
19 the kinds of things you need to be considering and
20 dealing with. But now, how do you take that global
21 process and apply it on these very specific types of
22 applications, which is what this NUREG is.

23 So I'd have to think about how difficult
24 would it be to maybe include a write-up of what this
25 global process would be. It may not be that

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1 difficult, I don't know. But it's something that we
2 could certainly looking into.

3 MEMBER BLEY: It's worthwhile.

4 CHAIR STETKAR: And now I'll bring up, I
5 found the quote in my notes here.

6 MEMBER BLEY: Well go ahead.

7 CHAIR STETKAR: And it sort of dovetails
8 with what you were saying, Dennis, in terms of a broad
9 applicability of this process. And the quote is, and
10 it's in Stage A, it says, "Internal NRC activities may
11 use risk results and insights, however, the treatment
12 of the associated risk uncertainties are not subject
13 to the process in this NUREG. While the risk analyses
14 associated with NRC activities do have uncertainties
15 the treatment of these uncertainties is addressed by
16 a different process that is outside the scope of this
17 NUREG."

18 MEMBER BLEY: Well I guess it's just
19 subject to that's generally, to me you'd evaluate the
20 same.

21 MS. DROUIN: Where are you reading?

22 CHAIR STETKAR: I don't know, it's
23 section, I don't have the page number here, it's in
24 Section 3 where it's --

25 MS. DROUIN: Page 25?

1 CHAIR STETKAR: So this notion that this
2 NUREG is now focusing on a very, very prescriptive
3 process that applies to only a very narrowly focused
4 set of PRA quantitative license issues has, as Dennis
5 said, walked us into a corner that begs something else
6 to dig us out of that corner.

7 MS. DROUIN: And that was our original
8 mandate. But again, I think we can look into how
9 would we modify this to bring in this global process.

10 MEMBER BLEY: I think that's a good idea.
11 It's something that's desperately needed. And I think
12 you're real close to it. So maybe it's a different
13 document, I mean this is focused on PRAs and reviews
14 of PRAs. But the way it focuses on them it says,
15 don't use this for anything else, which is --

16 CHAIR STETKAR: I think if the goal of
17 this NUREG is indeed to provide kind of crisp guidance
18 for how to address issues of uncertainties in the
19 context of what we just said, that's fine. But it
20 shouldn't imply that that's the only place you need to
21 consider uncertainties.

22 MS. DROUIN: It was never meant to imply
23 that. It was never meant to imply that. And I know
24 that that language we could easily clean up.

25 MEMBER BLEY: I think that's a good idea

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1 because I can easily see somebody saying look, it says
2 right here, I don't have to think about this stuff.

3 MS. DROUIN: Okay, so now we're going to
4 move to Stage B and Jeff is going to walk us through
5 Stage B and C.

6 MR. LACHANCE: So are you in control of
7 the slides, Mary?

8 MS. DROUIN: Yes.

9 MR. LACHANCE: Okay. All right, so coming
10 out of Stage A, whether we change it or not, it's
11 going to be a determination that the treatment of
12 uncertainty for a risk informed activity being
13 considered fits within the scope of this document.

14 So the goal of Stage B is to determine if
15 the PRA has the required scope and level of detail
16 needed to essentially made a decision or mull and it
17 make a decision on the application. The required PRA
18 scope and level of detail can vary, substantially, for
19 different risk-informed activities.

20 But it's important that the PRA address
21 all the important contributors to risk. Whether it be
22 external hazards, low-power shutdown and what we
23 traditionally look at now is the risk during at-power
24 considerations.

25 So the guidance in Stage B has three

1 steps. The first one is you have to understand the
2 risk-informed application and the decision that you're
3 trying to make. And we'll talk about that a little
4 bit more. And then you identify, well does my PRA
5 have the scope and level of detail to essentially
6 model what you're changing in the plant. Essentially
7 does it have the hooks that you need to evaluate, all
8 the hooks.

9 And then Stage B-3 addresses how do you
10 deal with the fact that I may not have all the PRA
11 scope and level of detail. What can we do about it?
12 So just briefly this is a new section that essentially
13 consolidates guidance from the previous NUREG. It was
14 primarily in the old Section 6.2, that talked about
15 completeness uncertainty. But there's little pieces
16 here and there that address this. Next slide, Mary.

17 So Stage B-1 involves two things,
18 understanding the risk-informed application, what
19 we're changing in the plant, and then essentially what
20 is the decision or the results that we're going to
21 need to make our decision. So I think it's pretty
22 straight-forward to understand what plant changes are
23 going to be made or operational changes are going to
24 be made as a result of the application. That's pretty
25 straight-forward.

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1 The second part is understanding, we
2 essentially have the risk metrics that we're going to
3 be looking at. What results were we looking at to
4 make the decision. And for awhile the key
5 applications that we see now ISI, Tech Specs, I mean
6 there are regulatory guides that identify what are the
7 acceptance guidelines that you need to meet. But
8 there are always maybe unique applications where those
9 will have to be formulated.

10 And the typical ones that you see, for
11 example Reg Guide 1.174 is CDF, LERF, delta CDF, delta
12 LERF, you know, importance measures. And there's a
13 variety of other measures that I'm sure you're all
14 aware of.

15 The next bullet says the acceptance
16 guideline should also include guidance on how the
17 metrics is to be calculated. Particularly with regard
18 to addressing uncertainty. And an example of that
19 obviously is the one Mary cited earlier in Reg Guide
20 174, is we're going to calculate the mean value,
21 taking into account state-of-knowledge correlation.
22 So that's the type of guidance I'm talking about here.

23 So all the impacts of the proposed
24 application need to be looked at. Can include effect
25 on prevention features, things that can cause an

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1 initiating event. Mitigation features can be
2 hardware, procedural, tech spec type of things. Next
3 slide, Mary.

4 So Stage B-2, the purpose of it is to
5 determine if the PRA scope and level of detail needed
6 to support a risk-informed application, does it have
7 that scope of detail. So just to go over this real
8 briefly here I think you're aware of the three aspects
9 on the PRA scope.

10 And the first one is the metrics used to
11 evaluate risk. Well you want to ask how does that
12 impact scope. Well obviously if you're just doing CDF
13 and LERF you can do just abbreviated Level 2.

14 But if your metric goes all the way up to
15 the qualitative health objectives then you need a
16 Level 3 PRA. So it essentially addresses the level of
17 PRA that you need.

18 MEMBER BLEY: Jeff?

19 MR. LACHANCE: Yes.

20 MEMBER BLEY: Let me ask you a question,
21 because my memory is not 100 percent clear on this.
22 The PRA standard, now I'm remembering the original
23 Level 1 PRA Standard, had a process for doing the same
24 thing. My two questions are in the unified standard,
25 has that been expanded to cover the kind of things

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1 you're just talking about now? The Level 2 issues and
2 that sort of thing. And in what areas are we not
3 being redundant with the standard? What are we
4 bringing in here that's new, in this Step B?

5 MR. LACHANCE: The first question is, I
6 mean that logic sort of remains the same but there are
7 examples that have been expanded to address, well
8 actually Level 2 hasn't been brought into it yet.
9 Okay, so it really hasn't --

10 MEMBER BLEY: Okay. It hasn't, I couldn't
11 remember if it had or not.

12 MR. LACHANCE: But is has brought in
13 external hazards, decisions upon that. But you know,
14 as low-power shutdown and Level 2 and Level 3 are
15 incorporated and will hopefully be revisited in the
16 standard in that one section to address what level of
17 PRA do you need for an application.

18 Now the second one is, is this redundant
19 or consistent with --

20 MEMBER BLEY: And if it's not redundant
21 what are the things you're introducing here that are
22 aren't available in the standard?

23 MR. LACHANCE: Well I think it just
24 parallels it, you know, the logic in there --

25 MEMBER BLEY: I'm not objecting to having

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1 it here. I think it's a coherent picture now.

2 MS. DROUIN: It's very consistent. The
3 difference is is that you have to remember the
4 standard gets more at a what to do, and what this does
5 it goes a step further and gives you a little bit of
6 how to do it.

7 MEMBER BLEY: How to do it, okay. Okay,
8 fair enough. Thanks.

9 MR. LACHANCE: All right. Now, with
10 regard to plant operating states and the type of
11 hazard groups. Okay, that you include. I think
12 that's pretty obvious, you know, if you changed your
13 plant it is going to impact a mitigating system that
14 can affect the risk in low-power shutdown or from an
15 earthquake. And obviously you need to consider that
16 as part of your PRA scope.

17 Now level of detail is the other thing.
18 We're all PRA practitioners and we know even in the
19 current Level 1 at-power PRAs we do include some
20 coarseness in the modeling that addresses level of
21 detail. You know, we break up LOCAs into three
22 groups. And that's usually pretty good. And we may
23 not include all mitigating systems. But potentially
24 it could be utilized when we make those decisions for
25 the sake of making modeling easier.

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1 So there may be some things missing from
2 your PRA model. It can be sequences, initiating
3 events or component failure modes. Typically in PRAs
4 we don't include spurious valve opening, for example.
5 That all addresses level of detail. Next slide, Mary.

6 So the key is I don't know how to make it
7 any more harder, or it just seems simple to me, is
8 that once you identify what your plant change is is
9 essentially use a cause and effect relationship. Say,
10 okay, this change is going to modify these components
11 or this failure mode. It's going to cause a new
12 initiating event. And essentially you translate that
13 into well, I got to go change my PRA model to
14 essentially have those hooks for the plant change.

15 There's some examples that are listed
16 there on how your plant change could impact the logic
17 structure. New initiating event, a component failure
18 mode, et cetera. I'll let you look at those. Next
19 slide, Mary.

20 So essentially Step 3 is you've done the
21 evaluation and what you're going to find out is that
22 well either my PRA has necessary scope of level
23 detail, and if it doesn't I've got to do something
24 about it. And we'll talk about that a little bit more
25 on the next slide.

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1 But what I want to continue to talk about
2 on this slide is the fact that Stage B I think may be
3 the only place in the NUREG that talks a little bit
4 about aggregation. It talks about the conservative
5 bias that you can potentially have, and a lot of
6 people discuss with regard to, well, we don't model
7 external hazards as well as we do internal hazards.
8 We have a lot of conservatisms, more conservatisms,
9 bias, you know, in how we do that. There's been a lot
10 of discussion about with regard to internal fires.
11 And to some extent that's true.

12 And so the problem is is when you're
13 putting all the scope together and aggregating the
14 results, then what do you do about it with regard to
15 uncertainty.

16 CHAIR STETKAR: Jeff, one of the, I guess,
17 gnawing concerns I have with the NUREG, and you just
18 sort of mentioned something that was a good hook into
19 that, it that the NUREG implicitly, if not more
20 strongly, states that everything in a PRA must be
21 conservative. And because of that, implicitly
22 remember, I didn't say explicitly. And because of
23 that you only need to look at the most important
24 contributors to a set of results because everything is
25 really conservative.

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1 Uncertainty has taught us that you might
2 have been optimistic. It might be optimistic bias.
3 If I make a decision, you know, I try to be
4 conservative. I've made several decisions in my life
5 in PRAs, I've discovered, as I've aged, that some of
6 those indeed were optimistic and some of them were
7 grossly optimistic. I didn't do a word search, the
8 word optimism might be in the NUREG, but I didn't do
9 a word search.

10 There's no sense in here, it says
11 conservative bias. We need to account for
12 conservative bias because that might be pushing the
13 numbers too high. What about the optimistic bias
14 that's pushing the numbers too low?

15 What about the sources of uncertainty that
16 affect cutsets, that are driven down because their
17 values are too low so that we never see them as
18 significant or important or whatever words you want to
19 use? That notion really isn't in this NUREG anywhere
20 either.

21 MR. LACHANCE: You're correct. I don't
22 think we really have talked about that and I think
23 that's a valid point. And it can cut both ways.

24 MS. DROUIN: It can certainly cut both
25 ways. And when you look at the standard there's been

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1 this misinterpretation by numerous people that as you
2 go from capability category 1, to 2 to 3, that you go
3 from conservative to less conservatism. And that's
4 absolutely not true. What you're doing is you're
5 going from a simple PRA to a more complex PRA and the
6 simple PRA may not be conservative.

7 CHAIR STETKAR: That's right. Not only
8 simple to more complex, but hopefully a PRA that has
9 broader uncertainties because you've had to make some
10 really wild guesses about things.

11 MS. DROUIN: Exactly.

12 CHAIR STETKAR: To something that's
13 supposedly more realistic because you have better
14 data, you've done more analysis, you have a better
15 technical support for the underlying basis for that
16 PRA.

17 MS. DROUIN: Exactly. So when you think
18 about your uncertainties in that light and we probably
19 should go back through and try and see if we can
20 change that flavor, because we aren't trying to say
21 that you're just looking at the stuff that's
22 conservatism, you're looking at what are those sources
23 of uncertainty and what are their impact. And their
24 impact could be good or bad in that way.

25 CHAIR STETKAR: I just, you know, because

1 as I read through the thing, and I read through the
2 whole thing again because I hadn't looked at it in a
3 couple of years. You just keep getting this flavor of
4 conservative bias. Of you need to look at the
5 numerically significant contributors and assess your
6 uncertainties about those. And the whole notion that
7 whatever is done is either realistic or conservative
8 and therefore you can then afford to look at what you
9 can see.

10 MEMBER BLEY: I think maybe what happens
11 is you go from the conceptual description, where it is
12 identify all your sources of uncertainty, to
13 proceduralizing it. But that's where it just kind of
14 naturally went. But I think if you just read it
15 straight through again you'd feel this thing that
16 John's talking about. Even if you just search for
17 conservative and read around every place it says that.

18 MS. DROUIN: This is very good input
19 because I can tell you we did not have any discussions
20 that was our intent to put that flavor in there. That
21 was not our intent, so if that flavor is coming out --

22 CHAIR STETKAR: It came across to me
23 anyway, but I'll firmly admit I'm very sensitive to
24 that issue.

25 MEMBER SCHULTZ: And therefore it's coming

1 across that way in the slides. But the way you spoke
2 it in response to John's question I thought was
3 appropriate. But that's the focus that I believe the
4 goal of the document is trying to capture is that as
5 you look at biases you're not only looking at the
6 conservative biases. You're looking at where the
7 uncertainties lie that have been treated by bias and
8 trying to extract those as you go to another level of
9 sophistication with respect to the modeling and
10 representation of uncertainty.

11 MEMBER BLEY: Yes, I agree with both of
12 them. And I'd go back to the thing you two were
13 talking about earlier. In principle, if you did a
14 Level 1 PRA the way, at least I would envision it, if
15 you fully thought about and characterized the
16 uncertainty in that Level 1 PRA your result probably
17 would be conservative because you've allowed for high
18 extremes as well as low extremes and that would bias
19 the result.

20 Now, I'm afraid most people who do a Level
21 1 kind of PRA don't think hard enough about the
22 uncertainties to capture that sense and as you
23 progress the same thing happens. So if this helps
24 people give good thought to the uncertainties both
25 ways it will lead to better characterizations. And in

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1 that sense then I think the final number would
2 probably go down as you went from 1 to 3, but only
3 because you had allowed for really extremes on the
4 uncertainty bounds in the Level 1. Just an aside.

5 MS. DROUIN: Okay.

6 MR. LACHANCE: Okay, that's a very good
7 comment and I take that. So this is the last step
8 from Stage B. So just to quickly reiterate, so we've
9 identified what we're going to change in the plant.
10 We identified what scope of the PRA and level detail
11 we need to address all the impacts of the proposed
12 change.

13 And so here's the conclusions that you can
14 arrive at. Number one is, that a PRA is adequate
15 support to application. And so if that's true then
16 essentially you go to the next stage in the process,
17 actually Stage D, which is to essentially assess the
18 parameter uncertainties, of course you have to modify
19 the PRA to account for those specific changes to the
20 plant.

21 If it's not adequate and the licensee
22 decides to refine the PRA, so you go up there and you
23 add that external vent you're missing or a low-power
24 shutdown or you add an initiating event. Okay,
25 essentially go back, modify and then again you're back

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1 in Stage D to essentially modify the model and address
2 parameter uncertainties and then later uncertainties.

3 Or if it's not adequate then the licensee
4 could decide to redefine the application. So maybe
5 it's too hard to generate a seismic PRA so I'm going
6 to redefine the application so that it does not impact
7 seismic risk. So that's another conclusion you could
8 reach. And to do that you go to Stage B. Go back to
9 Stage B and essentially repeat this process a little
10 bit.

11 And then the last one, if it's not
12 adequate and the licensee can decide to term the
13 significance of the missing scope and here, again,
14 sort of the conservatism here what you're trying to do
15 here is do a screening assessment, okay. We'll talk
16 about that in Stage C, but essentially you're going to
17 assess the significance of the missing scope. And
18 that's done in Stage C, which is the next one we're
19 going to talk about.

20 All right. So we're going to come in here
21 and essentially what we want to try and do, the
22 guidance is for licensee to address the missing scope
23 or level of detail. And that's generally done by
24 determining where the missing scope, is it a hazard,
25 initiating event, whatever, are significant to the

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1 decision under consideration.

2 And there's two steps. The first one is
3 we're going to try to do a screening analysis on the
4 missing item, to see if it's important. It can impact
5 the decision. And Step 2 is to determine if the PRA
6 model needs to be updated or if the application needs
7 to be modified to address the missing PRA scope.

8 So the risk from each significant hazard
9 group's cause, accident sequence needs to be developed
10 in accordance with an NRC-endorsed consensus standard
11 for that hazard group. That's Commission policy. If
12 there's an endorsed PRA standard then you're supposed
13 to generate a full PRA for that particular hazard.
14 And I don't know if policy is the right word, maybe
15 it's guidance, to do that. Next slide.

16 Okay, so in each of these steps we're
17 trying to identify what's changed from the previous
18 version. So there really hasn't been much change on
19 the completeness uncertainty guidance. Primarily we
20 just moved it up earlier, before the parameter and the
21 model uncertainty and that's because you need to
22 essentially address completeness and uncertainty and
23 include the missing scope before you even get to
24 addressing the model uncertainty and the parameter
25 uncertainty. So that's why we moved it up front.

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1 Process in Step 1 of the old version,
2 determining the required scope level detail, well I
3 just went over that, it's over in Stage B now. And we
4 included a table to identify supporting requirements
5 in the PRA standards that address screening
6 requirements.

7 We didn't get into any great discussion on
8 what are in those supporting requirements. But again,
9 this is going to be part of an ISG that's being worked
10 on. Not only to have certainty but also screening
11 requirements.

12 And the last bullet, hopefully we
13 reorganized this so it's in a little bit more concise
14 manner than what the previous version is. I guess
15 you'll let us know all that, right? Okay. Next
16 slide.

17 Okay, so step C-1, the purpose is to
18 provide guidance for determining whether missing scope
19 or level of detail of the PRA is risk-significant to
20 the decision under consideration. The process to
21 determine risk-significance of a missing scope or
22 level of detail can include performing either
23 qualitative or quantitative.

24 One thing we need to iterate here is that
25 a lot of these screening criteria and screening

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1 analysis may have gone through some of these in the
2 PRA, the applicant, as part of the IPEEE process,
3 because they did do some screening, for example, on
4 external hazards. Unfortunately most utilities
5 haven't done a low-power shutdown PRA and so there
6 probably hasn't been much done with regard to
7 screening positives.

8 So the point I want to make here is that
9 you may have done some previous screening, and you may
10 not. And if you've done any previous screening you're
11 probably going to have to revisit that screening for
12 a particular risk-informed application, because the
13 reason you screened it out may have changed. And so
14 you always need to revisit that.

15 Another factor is in some cases the
16 screening criteria has changed. For example in the
17 IPEEE, there was a screening criteria that if the
18 design basis met the '75 version SRP you could screen
19 it out. And that actually was incorporated into the
20 PRA standard.

21 But the new version that's come out,
22 Addendum B, has eliminated that. And so if you
23 screened out anything based on that criteria, you
24 know, a peer reviewer may not accept that criteria
25 anymore.

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1 (Off the record comments.)

2 MEMBER BLEY: So while we're just sitting
3 here, let me ask a question. Since this draft has
4 been available --

5 MR. LACHANCE: It's predecisional.

6 MEMBER BLEY: I'm sorry. Have you had the
7 opportunity to give this to somebody who wasn't
8 involved in developing this and have them go through
9 and use it and tell you how it worked for them? You
10 know, somebody that had never seen it before?

11 MR. LACHANCE: Well we did on the previous
12 draft. I mean, that's Appendix A has an example
13 application. Now, I cant' say that the person hadn't
14 seen it. They were people who worked on that
15 particular example, who were familiar with it. They
16 didn't write it but they had worked over on the EPRI
17 side and so they were familiar with the general
18 content. But somebody who's completely devoid of any
19 knowledge, no we haven't done that yet.

20 MEMBER BLEY: Interesting. I mean it
21 seems usable but it would be nice to know how it works
22 for people who weren't involved in the developing.

23 CHAIR STETKAR: Is there any, do you know
24 if EPRI has any plans to pilot this?

25 MS. DROUIN: I'm sorry, what was your

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1 question?

2 CHAIR STETKAR: Does EPRI have any plans,
3 we'll ask EPRI later perhaps it would be better, any
4 plans to pilot this?

5 MS. DROUIN: Well it's piloted through
6 that example.

7 MR. LACHANCE: A new pilot? I don't think
8 there's any plans, no.

9 CHAIR STETKAR: Yes, but that's all of us
10 kids getting together an making up the rules for the
11 game that we decide to play. It's, as Dennis
12 mentioned, a pilot would be a real-world example by
13 people who have never seen this documentation before.

14 MEMBER BLEY: Weren't involved in
15 developing it.

16 MS. DROUIN: That question would really go
17 to NRR to See Meng. I mean we can take it up with
18 them.

19 MEMBER BLEY: There were just things about
20 it, reading through it, that, you know, I'm not sure
21 if I were brand new to trying to do this if I'd have
22 said wow this is great guidance, I can go step-by-step
23 through this. Or if I'd have had some trouble getting
24 into it. There's some stuff up front that I thought
25 was a little awkward in trying to understand for how

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1 the whole piece hangs together and what we ought to be
2 doing to it.

3 MS. DROUIN: Well that is what Appendix A
4 did, it's illustrated but it was a real example. It
5 wasn't a real example that somebody had submitted but
6 we took a real, if somebody wanted to do that, and --

7 MEMBER BLEY: But it's always different
8 when you give it to somebody who wasn't involved in
9 the development to say, here's your guidance, give
10 this a whirl. You know, read it front to back and
11 apply it to something new for your plant.

12 CHAIR STETKAR: If you look at the history
13 of NUREG/CR 6850, admittedly much more complex with
14 many, many different things going on. But
15 conceptually here, but in a parallel sense the folks
16 who wrote that thought that they had perfectly
17 wonderful, coherent guidance. For whatever reason a
18 pilot of the guidance in an interim form wasn't done,
19 a complete pilot.

20 And now that people are developing real-
21 world, under the gun license applications people are
22 saying well, gee, we should have piloted this thing
23 because we don't understand what the guidance means.
24 Or the guidance is conflicting, or the guidance is too
25 conservative. Or the guidance is this or that.

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1 MR. LACHANCE: That's one reason why we
2 give a course on NUREG 6850 twice a year, to explain
3 all that.

4 CHAIR STETKAR: That's true.

5 MEMBER BLEY: That's true.

6 MR. LACHANCE: And we think it helps. And
7 I understand a lot of criticism on 6850, I am involved
8 in that.

9 MEMBER BLEY: I just think it applies to
10 anything that you're -- And we're tainted as well. I
11 mean we've seen this in the development so it looks
12 great.

13 MEMBER SCHULTZ: And it's very difficult,
14 you have a public comment period or review of that
15 type and it's generally those that are --

16 MEMBER BLEY: All of the know how.

17 MEMBER SCHULTZ: They are know how,
18 they're experts in the field or at least have
19 sufficient experience so they feel comfortable
20 commenting on the guidance. And, as Dennis said, the
21 real test is when someone that has not been involved
22 in developing the guidance needs to use it.

23 MS. DROUIN: Yes, all I can say is that we
24 can talk to EPRI and NRR and NRO and between all of us
25 see do we feel there's value in doing a pilot.

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1 MEMBER BLEY: Okay.

2 MR. LACHANCE: All right, so we want to
3 try and address the missing scope using the smart-
4 person approach, and now let's see if we can screen it
5 first, make it disappear before we do anything. And
6 so you can do successive steps in screening.

7 You can start with qualitative screening,
8 move to quantitative screening after that. And then
9 step C-1.3 is determining the significance of anything
10 you couldn't screen out. That's where you're sort of
11 stuck. So next slide, Mary.

12 So Step C-1.1 is the first one,
13 qualitative screening. And, as Mary mentioned, the
14 staff is working on a position on acceptable
15 qualitative and quantitative screening that could be
16 used. I don't know if you're that familiar with the
17 PRA standard but if you look at the screening criteria
18 through the different parts they're all over the place
19 and they're inconsistent. And there's an effort going
20 on in the Committee on Nuclear Risk Management to
21 address that.

22 But in the interim the staff's going to
23 develop this Interim Staff Guidance to address that
24 issue. So I gave a couple of examples there. The
25 first one, does the hazard result in a plant trip.

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1 Well, you may have already done that but again you've
2 got to go revisit and see if the application changes
3 that conclusion.

4 And the second one, the plant response to
5 the hazard is not affected by the proposed
6 application. That's what you always hope. Again, you
7 could redefine the application so that's the case.

8 And the third, contributor or hazard can
9 be bounded by another event. So these are just a
10 couple of examples of what you might see eventually in
11 the ISG.

12 And always leave the out to the applicant
13 to define their own criteria and provide the basis for
14 it. Don't want to be so prescriptive that something
15 you may not have thought about they can come up with
16 a reasonable screening criteria. So next one, Mary.

17 CHAIR STETKAR: Jeff and Mary, one of the
18 cautions I have, and again, step back and try to read
19 this from the perspective of a potential licensee or
20 applicant. Be really careful about the examples that
21 you choose throughout the document. The document has
22 a large number of examples. Regardless of how you
23 qualify those examples, saying these are only examples
24 and you need to do things right when you do it, they
25 are examples and they are in an NRC document and

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1 people will focus on them.

2 An example, of an example. In the
3 discussion of qualitative screening it says, "An
4 example of a scope item that is not important to the
5 change in risk is the following; an application to
6 change an at power technical specification would not
7 impact low-power shutdown risk and thus a lack of a
8 low-power shutdown PRA would not be an issue regarding
9 the necessary PRA scope to address the application."

10 Suppose I have a multi-unit site that
11 shares a lot of support systems. Or even front-line
12 systems. Taking something out of service while Unit
13 1 is at-power does affect the shutdown risk on Unit 2
14 when it's shut down.

15 Be careful about these examples that you
16 put in, because people will read that and think of my
17 old, gee, I have six units at my site. They're all
18 interconnected but I do the PRA only on unit-by-unit
19 basis. And say well, just because I have no low-power
20 shutdown model for any of them I don't need to look at
21 this or an integrated site-level PRA.

22 MR. LACHANCE: Good point.

23 CHAIR STETKAR: And just do that. I mean,
24 I have several examples here, but in the interest of
25 time I won't.

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1 MR. LACHANCE: Well we actually made --

2 MS. DROUIN: I will say in defense of the
3 team is that that was one of the big criticisms we got
4 from the ACRS is that we didn't have examples and to
5 go put examples in.

6 CHAIR STETKAR: A lot of the examples are
7 really, really good. They are really, really good.
8 I don't have the notes on gee, this is a really good
9 example. But do try to read through those things for
10 sensitivity. And I'll a couple others that I want to
11 get on the record for quantitative, but I wanted to
12 bring this one up in terms of the qualitative
13 screening.

14 MS. DROUIN: Thank you.

15 MEMBER SCHULTZ: One other example is that
16 you just covered on the previous slide, the
17 contributor or hazard can be bounded by another event.
18 It's very important to understand what bounded means.
19 A PRA analyst would consider bounded perhaps in the
20 proper context. But a safety analyst would think of
21 an event being bounded in a way that would not
22 necessarily appropriately account for risk.

23 MR. LACHANCE: Yes, I understand that.
24 That's a good comment.

25 MS. DROUIN: Now, my question would be,

1 because I agree with your comment, but I would go on
2 to ask you, because we did try and give guidance of
3 what we meant by bounding and what made it acceptable
4 or not. Was that sufficient to address your concern?

5 MR. LACHANCE: That is the next slide,
6 we're coming up to that.

7 CHAIR STETKAR: Yes, I was going to wait
8 for my quote on bounding until we get to quantitative.
9 The simple answer is no.

10 MR. LACHANCE: Okay. So just subset C-2
11 is essentially similar to 1 except it's using
12 quantitative type of analysis. And we identify
13 different levels of quantitative analysis that you can
14 use and we defined them here as you can use a bounding
15 conservative analysis. And we defined bounding as
16 really being the sort of the worst credible scenario
17 that can occur and it can be bounding in terms of just
18 frequency or --

19 MEMBER BLEY: There's that word again.

20 CHAIR STETKAR: I'm glad you picked up on
21 it. The credible word.

22 MR. LACHANCE: Okay. You know, I give you
23 an example there and you can back off from that a
24 little bit and use a conservative but not necessarily
25 worst case type of scenario.

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1 CHAIR STETKAR: Now, Jeff, I understand
2 that at one level, and I understand the general
3 philosophy of what you're getting at here. Let's take
4 that example. "For example, assuming that all fires
5 or floods in a specific area (maximum frequency) fails
6 all equipment in that area (maximum consequences)
7 combined with taking no credit for mitigation systems
8 (fire suppression or floor drains).

9 What is the maximum frequency of a fire in
10 this location? Is it the 95th percentile of the
11 uncertainty distribution? The 99th percentile of the
12 uncertainty distribution? The 100th percentile of the
13 uncertainty distribution? Something that's larger
14 than the 100th percentile of the uncertainty?

15 What is that maximum, you're going to say
16 credible, so I'll say it, what is the maximum credible
17 frequency of the fire given the underlying uncertainty
18 distribution?

19 MR. LACHANCE: Using the fire PRA
20 methodology it would be the contribution from all
21 potential ignition sources in the room?

22 CHAIR STETKAR: Yes.

23 MR. LACHANCE: Okay, and it would be the
24 mean. Okay.

25 CHAIR STETKAR: No, no it's not the mean,

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1 because there's a substantial probability that the
2 frequency is higher than the mean. Which may be a 60
3 percent, well no I'll use maybe a 30 percent
4 probability that I lose 60 percent of my net worth.

5 MR. LACHANCE: I understand the comment.

6 CHAIR STETKAR: Well, no but it's a real,
7 this whole notion, Mary asked have you sufficiently
8 defined bounding. No, you have not.

9 MR. LACHANCE: Okay.

10 CHAIR STETKAR: A bounding means it can't
11 be any worse, either in frequency or consequences.

12 MS. DROUIN: Now I agree with that.

13 CHAIR STETKAR: So if I'm defining a
14 maximum frequency I'd better understand what that
15 means. And it's not the highest, it's the sum of
16 several means. It's not necessarily the 95th
17 percentile of an uncertainty distribution, it's the
18 maximum frequency, whatever that means. I don't know
19 what it is.

20 MR. LACHANCE: All right, we threw this in
21 --

22 MS. DROUIN: But this is a case where for
23 practicality sake we may have to just come in and say,
24 for example, and I'm not saying that's what we're
25 going to do, but we might have to just come in and say

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1 it's the 95th.

2 CHAIR STETKAR: It's two levels. Number
3 one it is really important to understand what bounding
4 means, because when we get to Appendix A and several
5 of the other anecdotal examples in here that word is
6 used quite a bit. And it's not at all clear, to me
7 anyway, in several of the examples that they are
8 indeed bounding assessments.

9 You know, if you all get together and say
10 that the 95th percentile is a bounding assessment I'll
11 say well, there's five percent probability that it's
12 worse. So it might be conservative compared to the
13 mean, but it's not the worst case assessment.

14 MEMBER BLEY: But if you went to where
15 John goes, to a real worst case, I've never seen a
16 real worst case I couldn't make worse. This is a
17 tough area to define.

18 MR. LACHANCE: It is.

19 MEMBER BLEY: It's kind of you know when
20 you see it but it's real hard to define.

21 MR. LACHANCE: Let me tell you why
22 bounding shows up here. It's because it shows up in
23 that chapter you're referring to in the standard on
24 addressing missing scope in an application. And they
25 address using bounding type assessments.

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1 Quite frankly I don't know if you can
2 ever, ever convince anybody you're going to be
3 completely bounding, but you'll hopefully be able to
4 convince them it's conservative compared to a
5 realistic. So I think the focus should be on the
6 conservative one rather than the bounding.

7 But of course then if you can't even do it
8 with the conservative just use the smart-person
9 approach, sharpen your pencil and then you start to
10 get more realistic. Keep getting more realistic until
11 you can make it go away, if you can make it go away.
12 And if you're not, you're sort of stuck. I mean
13 that's the process I always used when I did a PRA.

14 MS. DROUIN: And I think you know it's
15 just going to have come down to we're going to have to
16 apply some practicality. And yes, in an ideal, pure
17 world there's always going to be something that could
18 be worse. But for this definition this is what we
19 mean by the worst.

20 MEMBER SHACK: The Standard's definition
21 says the outcome will meet or exceed the maximum
22 severity of all credible outcomes.

23 MR. LACHANCE: So we're not the only
24 guilty ones here.

25 MEMBER RYAN: I was thinking the same

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1 thing. I struggle with the, and I'm not a
2 practitioner of PRA so forgive me. But I struggle
3 with where these edges are and you seem to spend an
4 awful lot of time about these edges. And I appreciate
5 John Stetkar's comments.

6 When is the probability of something
7 happening small enough I don't need to worry about it
8 and I'm okay with the deterministic approach. That's
9 what I'm hearing as what we're trying to figure out,
10 is that it?

11 CHAIR STETKAR: Yes.

12 MEMBER RYAN: Okay, so one person's low
13 probability is another person's oh my god I can't
14 stand that. How do we get over that hurdle? I don't
15 mean to ask a hard question, but I'm just trying to
16 struggle with when will we know when we're done? I
17 would often ask that of all regulators when I was a
18 licensee, when am I done? Just tell me when that is
19 and I'll get there.

20 CHAIR STETKAR: Part of the notion is we
21 throw this word around, bounding. You know, why do we
22 need to use that word?

23 MEMBER RYAN: That's a good question.

24 CHAIR STETKAR: Why do we need to use that
25 word?

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1 MS. DROUIN: Because George told us in his
2 letter to the --

3 CHAIR STETKAR: No, no, I don't care about
4 -- You see George here? Why in 2012 do we need to use
5 something that nobody can understand what it means?

6 MS. DROUIN: I think that's a good
7 question.

8 CHAIR STETKAR: Only because the word is
9 used in the standard? Fine. This is we are the NRC,
10 we can define things in our new regs the way we want
11 to define them in our NUREGs the way we want to define
12 them.

13 MEMBER BLEY: You're going to have to come
14 up with that end point. And just saying don't use one
15 of the common words doesn't help. It doesn't. I mean
16 it's too easy. We use that because it's easy and we
17 think it covers the case but it --

18 MEMBER SHACK: Yes, but it's sort of like
19 pornography, you know, you can't define it but you
20 know it when you see it.

21 MS. DROUIN: And I'm not a believer, I'm
22 truly not a believer of those kind of answers, because
23 I think we know it when we see it and that's because
24 we have criteria in our head. And it's just really
25 forcing ourselves, through a systematic, structured

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1 way to pull that information out of our head and put
2 it in paper.

3 And I think we can do it we just don't
4 like to do it. But I think pushed up against, you can
5 do it. I mean it can be a challenge but I'm a
6 believer that it can be done.

7 CHAIR STETKAR: For pragmatism, and I'm
8 certainly not necessarily endorsing the notion of a
9 95th percentile as being bounding, but if one develops
10 that notion and makes it fairly clear at least users
11 of the guidance will understand what they need to
12 think about to establish something that's bounding.
13 Rather than just saying, well I'm doing a bounding
14 analysis. And I think it's bounding.

15 MS. DROUIN: And also it gives a starting
16 place that if you don't like 95 percent then why don't
17 you like it? And don't tell me I just don't like it.
18 Why don't you like it and what would you find
19 acceptable?

20 MEMBER SCHULTZ: I think that's a good way
21 to look at it, as a starting point. And I do feel
22 that that type of an approach would make more sense
23 than what is here. Bounding conservative analysis and
24 then stating it as that it includes the worst credible
25 scenario, as Dennis said, I'll think of a worst one.

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1 And so that statement itself really doesn't provide a
2 guidance. Once could say it doesn't make sense.
3 You'll never be able to do that.

4 MEMBER SHACK: But even in design basis
5 world we sometimes screen a 10^{-4} , sometimes 10^{-6} ,
6 sometimes 10^{-7} .

7 CHAIR STETKAR: Right.

8 MEMBER SHACK: And so our definitions are,
9 you know, we always have the definition in mind. I'm
10 not sure it's the same definition every time.

11 MS. DROUIN: Yes.

12 MR. LACHANCE: All right, Mary, let's move
13 on to the next slide. So Step C-1.3 is, you know, so
14 you've done the screening. Well if you can't screen
15 it out you can still use the conservative assessment
16 if it's low enough as part of your application. But
17 we provide some cautions about that as be careful.
18 The common example is they can really give you wrong
19 results with regard to importance measures and if your
20 application is strongly influenced by importance
21 measures you may get the wrong results.

22 Now the last one I already talked about,
23 is you need to revisit any assumptions you're using to
24 screen out things regarding the application.

25 CHAIR STETKAR: Jeff?

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1 MR. LACHANCE: Yes, sir.

2 CHAIR STETKAR: By the way, and to kind of
3 follow up on Bill's, I was looking for the quote. In
4 C-1.2, under quantitative screening, realistic but
5 limited quantitative screening there are two bullets
6 in that section. And it says a flood area can be
7 screened if the product of; a) the sum of the
8 frequency is of the flood scenarios for that area; and
9 b) the bounding condition or core damage probability
10 is less than 10^{-9} per year.

11 A fire compartment can be screened if the
12 CDF is less than 10^{-7} per year and LERF is less than
13 10^{-8} per year. Why do we accept either higher risk
14 from fires than floods? Or why do we hold floods to
15 a more stringent risk screening criterion than fires?

16 MR. LACHANCE: I don't think we should.
17 These are examples of coming out of the standards and
18 this is --

19 CHAIR STETKAR: That's fine. This is a
20 NUREG.

21 MR. LACHANCE: -- part of the
22 inconsistencies that we're going to address, okay?

23 CHAIR STETKAR: Okay.

24 MR. LACHANCE: I mean it's, like I said
25 earlier these things are inconsistent throughout the

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1 standard so we really need to fix this.

2 CHAIR STETKAR: Well the question is --

3 MR. LACHANCE: We're doing ISGs first.

4 CHAIR STETKAR: If you're going to fix it
5 in the standard are the ISGs on screening going to
6 address this?

7 MR. LACHANCE: Yes.

8 CHAIR STETKAR: I mean I'm thinking about
9 timing. I'd hate to see the NUREG get published and
10 out there with quotes like obvious inconsistent quotes
11 and it's simply because they're in the version of the
12 snapshot of the standard. You know, in the sense of
13 putting examples in, it's good to have examples, but
14 if they're obviously inconsistent you might not want
15 them in there.

16 MS. DROUIN: Okay. The NUREG, now you may
17 be catching stuff that we had missed. But the NUREG
18 is supposed to be, in a sense, ahead of the standard.
19 It is supposed to represent what the NRC position is.
20 And when we provided formal comments on the standard
21 one of our big complaints was that the screening stuff
22 was inconsistent everywhere, you need to fix it.

23 So we can't, in our NUREG, reference the
24 standard as the NRC position because it's incorrect.
25 So our intent is to have what's in the NUREG what is

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1 the correct thing that would be reflected in an ISG.

2 CHAIR STETKAR: Okay. Just then, if I
3 hear you, just then as I said earlier. Judiciously
4 please go back and kind of read those examples and
5 then bullets because you might stumble across things
6 that I've tried to highlight in a couple here. And I
7 won't take up more time with that, if you just do
8 that.

9 MS. DROUIN: We will do that. It's easy
10 for this to get away from us because we're so close to
11 it. But I appreciate this.

12 CHAIR STETKAR: Yes. And they're only
13 simple examples, that's the problem.

14 MR. LACHANCE: Okay, so next slide, Mary,
15 please. Finish up. So Step C-2, the final step, is
16 provide guidance for determining what to do, ways to
17 treat non-modeled scope or level detail items that you
18 have determined could be significant to the decision.
19 And significant is highlighted in there and its
20 inclusion in the application PRA can impact the
21 decision.

22 We talked about the standard a little bit
23 is that the risk of each significant non-model or
24 level-of-detail should be addressed using a PRA model
25 as developed in accordance with the consensus

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1 standard. Okay, for that, it has been endorsed by the
2 NRC staff.

3 However, if there is no standard that
4 addresses that missing scope then the licensee can
5 submit the results of his quantitative screening
6 analysis. Something that's not a complete, detailed
7 PRA for that missing scope. So next slide.

8 Now here's just a summary of Stage C.
9 That's if the missing scope level detail is not
10 significant to the application then essentially you
11 don't have to worry about it. Licensee moves on to
12 Stage D. If it is significant to the application but
13 there is no standard endorsed by the NRC the licensee
14 can submit his conservative analysis and move on.

15 But if it is significant to the
16 application and there is a standard endorsed by the
17 NRC then licensee has to make that same decision.
18 Does he redefine the application to remove that
19 missing scope item or does he make a decision to
20 upgrade the PRA to address the missing scope and move
21 on to Stage D. So that's the end of Stage C.

22 MS. DROUIN: Stage D.

23 MR. LEHNER: All right, I'll talk about
24 Stage D. For the record I'm John Lehner from
25 Brookhaven International Laboratory. So the objective

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1 of Stage D is to provide guidance to the applicant, or
2 licensee, on how to account for the uncertainty in the
3 parameter values in the PRA input when the PRA results
4 are calculated. That's the objective of this stage.

5 And the guidance involves three steps.
6 First of all, what are acceptable ways to characterize
7 the uncertainty in the parameter values of the inputs.
8 Step D-2, what are acceptable ways of propagating that
9 uncertainty to get to the quantification of the risk
10 metrics, and at the same time accounting for the
11 state-of-knowledge correlation. And then Step D-3,
12 provides guidance on comparison of the results with
13 the acceptance guidelines.

14 So in this step the licensee determines
15 whether the risk results challenge the acceptance
16 guidelines and how close they are. Next slide, Mary.

17 Now, before we talk about each one of
18 these steps we have to talk a little bit about the
19 ANS/ASME PRA standard. So the standard has a number
20 of requirements directly related to characterizing and
21 propagating parameter uncertainty. The standard, of
22 course, recognizes that the specificity, the realism
23 and the level of detail can really, in a PRA, depend
24 on what that PRA is being used for. It can vary
25 depending on the applications that you're going to use

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1 it for.

2 So the standard is written in terms of
3 three capability categories. And in general if you go
4 from Capability Category 1 to Capability Category 3
5 the level of detail, specificity and realism
6 increases. And this is true of the requirements in
7 the standard that deal with parameter uncertainty as
8 well. So what's acceptable for dealing with parameter
9 uncertainty depends on which Capability Category the
10 PRA is trying to meet.

11 So in the subsequent discussion, at least
12 for Steps D-1 and D-2, the guidance is provided in a
13 context that also provides the NRC's position on the
14 requirements in the PRA standard that deal with
15 parameter uncertainty. So if you want to go to the
16 next slide.

17 Okay, so one more item to talk about
18 before we get into the steps. What are the changes in
19 this stage compared to the document that you saw back
20 in March of 2009? Well as you've heard earlier the
21 scope was expanded so now we have to deal with
22 parameter uncertainties associated not just with
23 internal events but also with other plant operating
24 states, external hazards, fire and Level 2 PRA.

25 And also the second change in scope is

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1 that since then the NRC position for what is
2 acceptable for meeting the requirements on parameter
3 uncertainty in the standard has been further detailed,
4 defined and clarified. So that's really what's new in
5 this version from the previous version. Next slide,
6 Mary.

7 All right, so the first step is how do you
8 characterize the parameter uncertainty of the PRA
9 inputs. Ultimately what you want to do is you want to
10 get the PRA results the core damage frequency, the
11 LERF. You want to estimate those quantities with a
12 good mean values and an understanding of the
13 uncertainty about them.

14 But in order to do that you have to first
15 characterize the uncertainty of the inputs to the PRA.
16 And that's especially important for the parameter
17 uncertainty in the significant contributors. So
18 here's where we start talking about significant
19 contributors and you'll see that terminology used in
20 this guidance as well as in the standard.

21 And the significant contributor is not an
22 arbitrary term that the applicant can decide on what
23 it means. A significant contributor is defined, in
24 the standard, in terms of the context that it's used
25 in. Whether it's internal events, PRA, a external

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1 hazard or a Level 2, or a LERF analysis I believe.

2 And there's a chain of definitions here
3 that are all important because a significant
4 contributor is defined in terms of a significant basic
5 event. And then as well as in terms of significant
6 sequences or cutsets.

7 And the standard defines all those terms
8 and, as a matter of fact, gives some quantitative
9 guidelines for what constitutes significant sequences,
10 cutsets, as well as what are significant basic events.
11 So there are some quantitative guidelines in the
12 standards that make the significant contributor term
13 definitive rather than arbitrary.

14 Okay, so if we could now go on to the next
15 slide. So for Step D-1, what is an acceptable
16 approach for characterizing the uncertainty. Well for
17 the first category, for Capability Category 1, only
18 point estimates are required for the basic event
19 parameters and their uncertainty can be qualitatively
20 characterized by specifying some kind of interval or
21 perhaps even multipliers. But it doesn't have to be
22 a formal quantification.

23 For Capability Category 2, which is what
24 one would expect most applications to meet, the mean
25 value of the significant contributors, the mean values

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1 of the parameters of the significant contributors have
2 to be provided. And the uncertainty around those mean
3 values should be probabilistic representation of the
4 parameter values. So you need to probability
5 distribution, not just the mean value.

6 And, for Category 2, this is only done, or
7 only has to be done for the significant contributors.
8 For Category 3 you have to do the same thing, that is
9 mean value and uncertainty distribution for the
10 parameters for all of the inputs. So that's the
11 distinction since --

12 CHAIR STETKAR: John, since you've
13 obviously studied this quite a bit, how do I determine
14 a significant contributor. I know it's defined. How
15 do I do that? And I know it's defined even in the
16 NUREG as Fussel-Vessley importance greater than 0.005
17 or risk achievement worth greater than 2.

18 MR. LEHNER: That's for a basic --

19 CHAIR STETKAR: That's a nice
20 quantitative, that's a basic event, significant. How
21 do I do that calculation in the real world doing a
22 real PRA? I'll tell you how we do it. I quantify the
23 PRA using some numerical truncation and I throw away
24 a whole bunch of cutsets. I quantify some number,
25 which I'll call a number, from the remaining cutsets

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1 and I push a button and a whole bunch of math gets
2 done and out spews a list of numbers. And that is
3 comparing the basic event to that number that's
4 generated.

5 The whole point of the state-of-knowledge
6 correlation is that a whole bunch of the cutsets that
7 I threw away, if I actually accounted for that state-
8 of-knowledge correlation, would have contributed,
9 perhaps significantly, to that number, that I'll call
10 the number.

11 But I can't test that because I can't see
12 those cutsets because I threw them all away. And by
13 definition all their basic events are not significant.
14 So what am doing playing with the state-of-knowledge
15 correlation with only the things that I can look at?
16 How do I know it's not important to the results?

17 MR. LACHANCE: Well there is a certain
18 gray area there, I think.

19 CHAIR STETKAR: I'll tell you from PRAs
20 I've reviewed it's not so gray.

21 MR. LACHANCE: Well there's requirements
22 in the standard to essentially assess truncation. You
23 know, and being sure that you're not, you need to do
24 sensitivities on the truncations values and
25 essentially verify that the truncation is not --

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1 MEMBER BLEY: But this adds a new wrinkle
2 into it.

3 MR. LACHANCE: The state-of-knowledge?

4 MEMBER BLEY: Yes. Those things that were
5 truncate-able for all other criteria might bite you
6 here.

7 CHAIR STETKAR: Don't think about current
8 operating plants with two, and only two, trains of
9 things where I'll grant you X-squared is not a very
10 big number. Think about new plants with four trains
11 of operating things.

12 MEMBER BLEY: Or more.

13 CHAIR STETKAR: Or more. Where X ⁴th
14 starts to get significant compared to the 4th power of
15 X.

16 MR. LEHNER: Yes, I think that's why I
17 think it is bit of a --

18 MR. LACHANCE: So you would vote for doing
19 Capability Category 3, right? That's the only way
20 you're going to make sure?

21 CHAIR STETKAR: No, pragmatism is
22 important but I didn't read anywhere in this NUREG,
23 anything that sensitizes the user to this notion that,
24 gee, if you're going to investigate state-of-knowledge
25 correlation types of uncertainty you may need to, for

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1 example, test your PRA solution at various truncation
2 values. Generate different sets of cutsets and see
3 what the sensitivity to that overall result is when
4 propagating those uncertainties through.

5 I didn't read anything that even makes
6 people kind of sensitive to that issue.

7 MR. LACHANCE: Right. As a matter of fact
8 I think, if I understand you correctly, even Category
9 3 wouldn't necessarily address it, because you're
10 talking --

11 CHAIR STETKAR: No it doesn't.

12 MR. LACHANCE: You're talking about what's
13 been truncated and thrown away.

14 CHAIR STETKAR: That's right.

15 MR. LACHANCE: And so Category 3 would not
16 address, no.

17 CHAIR STETKAR: But I mean if a lot,
18 essentially all of this NUREG, in terms of parameter
19 uncertainty quite honestly, deals with state-of-
20 knowledge correlation uncertainties. And since the
21 NUREG makes such a big deal about it, and it can in
22 rare instances be numerically important --

23 MEMBER BLEY: But that importance is
24 related, and you could do a level something like this.
25 That importance is related to two things, whether

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1 you're x-squared or x to the fourth or x to the sixth,
2 and what's the error factor on your failure rate.

3 CHAIR STETKAR: Yes.

4 MEMBER BLEY: If the error factor is
5 fairly small x-squared doesn't matter much at all.
6 And x to the fourth only begins to. The error factor
7 is pretty big. Man, it jumps up fast. I think some
8 of the examples you cite the old Kaplan and
9 Apostolakis paper, which is the first one on this.
10 They did examples of x-squared and I think x to the
11 fourth and it's really linked to that error factor.
12 So as the error factor goes up this becomes much more
13 important.

14 So you could almost gin up some little
15 guidelines as to depending on whether you have error
16 factors exceeding a certain amount what you need to do
17 --

18 (Simultaneous speaking.)

19 CHAIR STETKAR: The EPRI report actually
20 had that. It had some of that.

21 MR. LEHNER: It had some of that.

22 CHAIR STETKAR: Yes, it had some of that
23 in it.

24 MR. LEHNER: Yes, the EPRI report actually
25 shows error factors versus, I mean, it rates the

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1 importance depending on the --

2 CHAIR STETKAR: Yes, it does have that
3 notion in it. I can't recall --

4 MEMBER BLEY: And I can drive an analyst
5 into how to begin to do test cases to see where it's
6 important.

7 CHAIR STETKAR: I don't recall whether the
8 EPRI report had much in it on kind of testing the
9 numerical truncation to then generate combinations of
10 basic events that you can go back and look at and say,
11 gee, there's a bunch popping up here and they have
12 high error factors so I need to be sensitive to them.

13 MR. LEHNER: Right. I guess we can go on
14 to the --

15 MEMBER BLEY: But the next group of
16 reactors that get licensed, if in fact they do, are
17 going to have this in spades.

18 MR. LEHNER: Yes, that's true with all
19 those trains.

20 MS. DROUIN: Our original --

21 CHAIR STETKAR: What's x to the sixth for
22 a squib valve, for example?

23 MEMBER BLEY: For a new squib valve, never
24 tested. Or only limited testing on it, big
25 uncertainty.

1 MR. LEHNER: The difference between x to
2 the sixth and the expected value of, the sixth value
3 of the expected value of x , right?

4 CHAIR STETKAR: It's a big deal.

5 MS. DROUIN: My original thought was that
6 the standards were making this way too complicated.
7 And that Capability Category 2 and 3 should just be
8 combined, because right now you have software that
9 just automatically does it. And just propagate.
10 Don't just try and figure out this is significant and
11 this isn't.

12 Just propagate your uncertainties for all
13 of them and make your life easy. Because you have to
14 quantify, initially, to find out what is significant.
15 And then you caught up in all of that, if you had just
16 propagated everything to begin with.

17 MR. DINSMORE: Yes, hi. This is Steve
18 Dinsmore from the NRR. I'd like to make a comment on
19 this before I get up there and you ask me the same
20 thing. Don't forget there's CCFs as well, so it's not
21 just the x -squared, it's plus stuff with CCF. So the
22 CCFs will mitigate some with this problem. I think.

23 CHAIR STETKAR: Well, go on.

24 MR. LEHNER: All right, so the next step
25 then is -- All right. I think I'm being told to move

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1 to Step D-3. Well anyway Step D-3 is the propagation
2 of the uncertainties that are again dependant on the
3 Capability Category. And again there's a distinction
4 between significant for Category 2 and all for
5 Category 3. And also, accounting for the state-of-
6 knowledge correlation, in any case in Category 3,
7 always in Category 2, you can calculate mean values
8 without the state-of-knowledge correlation if you can
9 demonstrate that the state-of-knowledge correlation is
10 not important.

11 Step D-3 then is comparing the PRA results
12 with the acceptance guidelines and so obviously you
13 need an estimate of the risk metric, which is
14 calculated and hopefully have gotten a good estimate
15 of your mean value. The acceptance guidelines and, in
16 some cases, the uncertainty distribution of the risk
17 metric. And if you go to the next slide, Mary.

18 In most cases you're comparing the mean
19 value of the risk metric with to an acceptance
20 guideline that's also been formulated in teams of mean
21 values. And the comparison should demonstrate to the
22 decision maker not just whether the guideline has been
23 met or not but also how close the results of the
24 analysis are to those guidelines.

25 And this sort of touches on a point that

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1 was raised earlier, you know, if I'm just using mean
2 values all the time why do I even bother with the
3 uncertainty distribution? Well, in some cases, I mean
4 obviously if your results are far away from the
5 acceptance guideline you're not going to worry very
6 much about the uncertainty.

7 But if you're close to the acceptance
8 guidelines then it may influence the decision if you
9 have a better idea of the uncertainty that's
10 associated with that mean value and how it was to
11 spread, et cetera. So then the decision maker may be
12 interested in that.

13 CHAIR STETKAR: I'm glad you brought that
14 up, John, because in particular in this section of the
15 report that notion does exist.

16 MR. LEHNER: Yes. That you would be
17 interested in the --

18 CHAIR STETKAR: Yes, that you might be
19 interested in it. And yet, back in the example it
20 says, well, we're not interested in it. It does.
21 This is the 95th confidence interval shows that you
22 could be in a different region but we don't care.

23 MS. DROUIN: I know that's in there.

24 CHAIR STETKAR: It's an example. I get
25 confused about one, two and three but it was the next

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1 worse one.

2 MR. LEHNER: All right, well actually
3 that's the end of Stage D. There is an appendix
4 associated with Stage D that just gives more
5 information about the state-of-knowledge correlation.
6 Nothing's really changed here from the previous
7 version, so I don't think we really have to go through
8 it. Unless you want me to.

9 CHAIR STETKAR: No. Thank you.

10 MS. DROUIN: And Tim's going to bring us
11 back on schedule.

12 CHAIR STETKAR: Tim's going to bring us
13 back on schedule after we take a break.

14 MS. DROUIN: Oh, I thought we were going
15 to go through his and then take a break.

16 CHAIR STETKAR: That's what you thought.
17 No, honestly we're going to start talking about model
18 uncertainty and we probably should take a break. So
19 let's recess until 3:15.

20 (Whereupon, the meeting in the above-
21 mentioned matter went off the record at 2:57 p.m. and
22 resumed at 3:14 p.m.)

23 CHAIR STETKAR: All right, let's reconvene
24 and hear about Stage E.

25 MS. DROUIN: And that's going to be

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1 presented by Tim Wheeler.

2 MR. WHEELER: Okay. Are we ready?

3 CHAIR STETKAR: We are.

4 MR. WHEELER: Okay, well good afternoon
5 everybody, and I am Tim Wheeler from Sandia Labs and
6 I'll be presenting Stage E, the stage that follows
7 Stage D and where we assess model uncertainties.

8 So the objective of Stage E is to provide
9 guidance to the licensee for addressing sources of
10 model uncertainty and related assumptions in both the
11 base PRA and the what we call the modified or the PRA
12 Developed for the purposes of the application, with
13 the goal to both, number one, make sure we have a
14 comprehensive identification, and understanding of all
15 the model uncertainty.

16 And then an understanding of the extent
17 and the degree to which those sources of model
18 uncertainty could potentially impact the estimate of
19 the risk metric, and to see if there is a possibility
20 of challenging or even exceeding that quantitative
21 acceptance guidelines.

22 There's two major steps in Stage E. Step
23 E-1, the step that involves the identification and the
24 characterization of the model uncertainties. Step E-
25 2, is the step where we take the identified model

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1 uncertainties and then analyze them against the
2 acceptance criteria using sensitivity analyses to
3 determine whether or not they are key to the decision.

4 The methods and guidance have
5 fundamentally not changed from Rev 0 to Rev 1. We
6 hope, and we think, that we've improved some of the
7 discussion and things but the real fundamental content
8 of the methods have not changed.

9 Step E-1, again, typically summarized,
10 provides guidance to identify and characterize the
11 model uncertainties. We have five steps that we lay
12 out to do this. I'll talk about those in more detail,
13 so we can go on to summarizing Step E-2.

14 E-2, having identified the source of the
15 model uncertainty that are relevant to the
16 application, this provides the guidance to determine
17 whether or not these model uncertainties are key to
18 application. And we do this, again, by performing
19 uncertainties. We provide guidance both for the
20 licensee to do conservative screening analysis so they
21 can hopefully pick out some low-hanging fruit without
22 doing the more complex analyses associated with
23 realistic sensitivity analyses.

24 In the original Rev 0 we had some feedback
25 from the industry saying we were a little bit over the

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1 prescriptive in our language and tried to address
2 that. They felt they came across as saying thou shalt
3 do conservative screening and then if necessary do
4 realistic. So we'd just like to readdress that so it
5 was providing guidance on as either an option to do
6 both or either. Okay, next slide.

7 Step D-1 we'll address in a little bit
8 more detail. We have identified, again this is the
9 process for identifying and characterizing the sources
10 of model uncertainty in the PRA. We've identified
11 five sequential steps. In reality obviously some of
12 these might merge together a little bit.

13 And Step 1.5 is to do the whole process
14 over again for the PRA associated with the
15 application. But we wanted to set each step out
16 explicitly to bring attention to each and drive home
17 to the licensee the needs to consider each aspect of
18 the step. Next slide.

19 So in Step E-1.1, this is the step where
20 we identify the model uncertainties in the base PRA.
21 And as you can see you have obvious sources such as
22 your own plant specific sources that you have
23 identified and have incorporated into the PRA model.
24 And then the EPRI report also contains a very useful
25 starting point for an analyst with a list of generic

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1 sources.

2 I'd like to point out that this step is a
3 requirement in the standard. So this is a step that
4 the licensee should be doing and they should have
5 successfully when they pass muster with their peer
6 review.

7 CHAIR STETKAR: Tim?

8 MR. WHEELER: Yes.

9 CHAIR STETKAR: And I have to admit I
10 didn't get a chance to go back and reread all of the
11 EPRI report. The NUREG talks about uncertainty within
12 the context, let's say, of a selected model. It
13 doesn't seem to talk about uncertainty related to the
14 selection of a model among a number of choices.

15 For example, MELCORE versus MAPP. For
16 example, CFAST versus MAGIC for fire analysis. For
17 example, Human Cognitive Reliability Model versus
18 THERP for human performance analysis. How are those
19 sorts of uncertainties addressed? Are they addressed
20 through the standard or are they addressed through
21 EPRI guidance?

22 MR. WHEELER: We do have as examples how
23 one's selection of a HRA methodology can introduce
24 model uncertainty into an analysis. We --

25 CHAIR STETKAR: It's stated.

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1 MS. DROUIN: The way we do it is that the
2 standard and NUREG 1855 talks about a consensus model.
3 And if a consensus model is being used then it's taken
4 off the table as a source of uncertainty.

5 CHAIR STETKAR: Okay. Both MAGIC and
6 CFAST are consensus models, they're both endorsed. I
7 suspect they will give you different results if you
8 run fires through them. I haven't used both of them,
9 it's just a suspicion, I would bet heavily that they
10 would. They're both conservative models.

11 MS. DROUIN: And they would not under our
12 process, good or bad, that's the position that has
13 been, you know, was adopted in the standard and we
14 further adopted it in 1855. Is that if it was a
15 consensus model then we did not disagree with the
16 standard that you would have to identify that as a
17 source of model uncertainty.

18 CHAIR STETKAR: What's the definition of
19 widely used and widely accepted, because I see those
20 words in here?

21 MS. DROUIN: That's a real good question.
22 And I don't have --

23 CHAIR STETKAR: Okay, well that defines
24 what a consensus is --

25 MS. DROUIN: Yes.

1 CHAIR STETKAR: -- according to what I've
2 read here.

3 MS. DROUIN: And as I noted earlier we
4 need --

5 CHAIR STETKAR: Does that mean if I have
6 five people three of them like it and two don't?

7 MS. DROUIN: Well that's where we're going
8 to need to provide some additional explanation.
9 Because I personally, you know, was that I wasn't
10 happy with that explanation. The more I've thought
11 about it I feel like we've bought into that definition
12 too quickly. I think it has some subtleties that
13 could really cause some problems.

14 CHAIR STETKAR: Because I mean in some
15 sense if three people like it and two people don't and
16 they're all experts and they give different results I
17 can weight things 60/40.

18 MS. DROUIN: Yes.

19 CHAIR STETKAR: Looking at what the
20 sensitivity of the results or the uncertainty in the
21 results might be. And that's one way to do it.

22 MR. WHEELER: Mary, I'll defer to you as
23 representing the regulator but I do believe that when
24 we define consensus model in this NUREG we did specify
25 that it has to have been either utilized or accepted

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1 by the NRC.

2 MS. DROUIN: Yes, that's true.

3 MR. WHEELER: So we did hook it back to
4 the NRC's opinion on consensus.

5 CHAIR STETKAR: There might be an or in
6 there, I'm not going to try to find it.

7 MS. DROUIN: But Tim is right. We did add
8 that on there that it has to be accepted by the NRC.

9 CHAIR STETKAR: Okay.

10 MEMBER SCHULTZ: But that provides --

11 CHAIR STETKAR: But that still --

12 MEMBER SCHULTZ: You should be comfortable
13 with these definitions.

14 CHAIR STETKAR: MAGIC and CFAST have both
15 been accepted by the NRC.

16 MS. DROUIN: But that was just one of the
17 limitations that we put on this NUREG.

18 CHAIR STETKAR: All right.

19 MR. WHEELER: Earlier today we had
20 discussions on optimistic bias and I would not be
21 surprised if when this team goes back to address that,
22 in addition to other parts of this NUREG, that we may
23 see some discussion of optimistic bias in this step,
24 because one of the things we did have from Rev 0 was
25 a table and discussion under identifying model

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1 uncertainties that have to do with issues related with
2 when you're dealing with a PRA of a design stage plant
3 or design.

4 So I, just based on what we heard earlier
5 today in the discussion of optimistic bias, I would
6 not be surprised if we see some new material being
7 added to 1.1 as well, because this is the part, the
8 process and consistent in alignment with the PRA
9 standard where the licensee has to demonstrate that
10 they've studied their models and their assumptions and
11 that they've documented and identified all of them
12 here.

13 Step 1.2 is identifying those model
14 uncertainties that are relevant to the application
15 within the base PRA. And I have, actually I was going
16 to stay typo but this is really a mistake. I think I
17 got fooled by reading headers and I was referring back
18 to step A-3, I think it's more appropriate to refer
19 back to B-1 where you've identified what part of your
20 PRA model that you're going to be applying to the
21 application process.

22 And so obviously from your full list of
23 the base PRA model uncertainties that you've
24 identified in 1.1 you don't need to worry about all of
25 them, potentially, depending on the scop of what your

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1 application is going to encompass.

2 And example being for the diesel generator
3 allowed outage time extension, you would be focusing
4 on loss of off-site power sequences, whereas, as we
5 also see in the other bullet there are risk-informed
6 applications that would, however, require that one
7 consider all of the model uncertainties in the entire
8 base PRA. Next slide.

9 Step E-1.3, this is where you've taken
10 your set of identified model uncertainties and you are
11 characterizing these model uncertainties as to how
12 they potentially affect and impact the PRA model.
13 Again, this is consistent with the requirements of the
14 PRA standard. I believe this is QU-E4, is where the
15 standard directs licensees to do this.

16 For example one would be does a particular
17 model uncertainty effect just a single basic event,
18 multiple basic events. Are we potentially affecting
19 the logic structure of an event tree or several event
20 trees or fault trees. Or is it somewhat more complex
21 combination of all the above. Or some of the above.

22 And I like to invoke a lot of the things
23 that Gareth Parry who, before he retired from the NRC,
24 worked on this extensively. And this is where he
25 always said this is all about understanding your PRA,

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1 both macroscopically and microscopically, knowing why
2 your results are the way they are and why things
3 behave the way they do given different assumptions.
4 And understanding how, for your model uncertainties,
5 what is the basis of the model that you used so that
6 you will better understand what the potential issues
7 associated with that model uncertainty.

8 And again, this included an understanding
9 of conservative bias to make sure that if your model
10 incorporates say perhaps reflects the deterministic,
11 conservative nature of your license basis, you need to
12 understand how that might be shielding potential
13 importance of other aspects of your model. And we've
14 already noted today that there's at least a tone that
15 we are ignoring optimistic bias. And I think we'll be
16 revisiting that as a team.

17 Step E-1.4. Qualitative screening of
18 relevant model uncertainties. I call this just a
19 backup to Step 1.1 and Mary brought this up where we
20 have allowed the licensee to take credit for if they
21 have used what is considered a consensus model. They
22 do not have to take the assessment of this model
23 uncertainty further. They have used an approach which
24 has at least received somewhat broad acceptance or
25 acknowledgment within the technical community. And

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1 that includes the NRC and what we said in the NUREG.
2 And example might be the Westinghouse reactor coolant
3 pump seal LOCA model.

4 Step 1.5, this is really we take the PRA
5 which has been developed for the purposes of the
6 application and we just go back to Steps 1.1 through
7 1.4. And, again, in reality a licensee might be doing
8 this in parallel but we just explicitly pointed this
9 out as a separate sub-step so that the analyst
10 understand they have to be careful and evaluate their
11 modified model and make sure they are or are not
12 introducing any potential new model uncertainties that
13 they didn't already identify in the first step. And
14 EPRI has examples of this as well.

15 So at the end of Step E-1 you have a list
16 of what I call candidate potential key model
17 uncertainties. They are, hopefully, as comprehensive
18 a set as possible to get of all the model
19 uncertainties in your base PRA and your modified PRA
20 for the application, which are relevant to the
21 application. As we said you can filter out those that
22 are just not going to be impacting the scope of what
23 the application involves.

24 And then Step E-2 is where we study these
25 using sensitivity analysis, it's conceptually very

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1 straight forward. You have to look at each model
2 uncertainty, perform a sensitivity analysis and
3 compare the results against the acceptance guidelines
4 and come up with a determination of does the
5 uncertainty associated with the model uncertainty
6 potentially cause the estimate of the risk metric to
7 approach, or even potentially exceed, the quantitative
8 acceptance guidelines.

9 If the answer is yes you've identified one
10 or more key model uncertainties. If the answer is no
11 then you have great assurances of demonstrating to the
12 NRC that the model uncertainties are not going to
13 impact the decision. In either case the applicant
14 then moves on to Stage F where they develop their
15 strategies for dealing with the results of their
16 uncertainty analysis.

17 CHAIR STETKAR: These sensitivity
18 analyses, I understand this whole process and it makes
19 a lot of sense. What I struggle with a bit though is
20 if a particular source of modeling uncertainty, if you
21 tested that, could give you a range of results.
22 Whether it's success criteria in terms of flow rates
23 or drain-down times or heat up, you name it.

24 There's not sense in here that -- There's
25 a sense that, well I can look at the sensitivity to

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1 the worst case if you will. And if I win with that,
2 however I define that worst case, I'm okay. But if
3 there's a spectrum, if I'm now bordering on the
4 acceptance criteria, there's no notion here of any
5 assessment of confidence in any of those possible
6 outcomes.

7 In other words, either convening a group
8 of experts to say well, you know, in my simple example
9 we'll assign 60 percent confidence to this outcome and
10 40 percent to this other outcome. Or in a broader
11 sense a more rigorous type of uncertainty evaluation.
12 I'm assuming that was deliberate, is it?

13 MR. WHEELER: I'm not sure I would say it
14 was deliberate in the sense that I think to a certain
15 extent we didn't want to be over prescriptive in some
16 of the guidance. But I think your comment that I
17 think the team should consider to see if there is some
18 additional guidance that we could put in there as to
19 how one may want to address what we call the various
20 realistic sensitive.

21 And so I think what you're suggesting in
22 your comment is we may want to think about additional
23 guidance within the context of looking at multiple --

24 CHAIR STETKAR: It could help, because if
25 you look at the example, and I'm not necessarily

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1 trying to be somewhat practical about this. In some
2 sense, if I look at the example they say well we did
3 this sensitivity analysis on modeling uncertainty,
4 let's say. And, gee, we could exceed our acceptance
5 criteria so we're going to implement some sort of
6 compensatory measures to make up for that.

7 If there was low confidence in that
8 particular set of sensitivity parameters a different
9 decision might be made by both the applicant and
10 considered in terms of a staff review of that
11 application. But there's not sense of that kind of
12 confidence. It just says well we did a sensitivity
13 analysis on something that we think could be this bad.
14 And look, it pushed us over our acceptance criteria.

15 So as an applicant I'm going to implement
16 some sort of compensatory measures to account for that
17 possibility.

18 MR. WHEELER: Well when we talked about
19 the conservative sensitivity analysis that was
20 definitely left out. I think that thinking may have
21 been imbedded in our discussion on realistic
22 sensitivity analysis, where we said things such as
23 alternatives are hypothesis that are considered
24 reasonable or have a broad acceptance in the technical
25 community and a sound technical basis. But that may

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1 --

2 CHAIR STETKAR: But those are pretty
3 qualitative issues.

4 MR. WHEELER: Right that may be leaving
5 some threads hanging from your perspective. So we
6 will take that comment within that context and see if
7 we can --

8 CHAIR STETKAR: It might help a little
9 help a little.

10 MR. WHEELER: -- tighten that up a little
11 bit.

12 MS. DROUIN: I think when you go into
13 Stage G, and I think some of it will be alluded to in
14 Stage F, that when, and I don't want to jump in and
15 speak for Steve, but one of the things they do do is
16 look at what is the adequacy, the technical
17 acceptability, of the PRA. And part of that is having
18 confidence in all the different things that you have
19 done. In particular having confidence that what
20 sensitivities you did were sound.

21 So I know that we've talked about it.
22 Maybe not as much as we needed to. But I do know that
23 we did allude to that as part of the Step review is
24 that they have to have confidence that the things that
25 they did in the PRA, the things they did to assess the

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1 uncertainties, was technically sound.

2 CHAIR STETKAR: That's true. And it does
3 talk to that, but again I'll come back, you read the
4 words as an outsider and you read the words as
5 practitioners will probably read them. And there are
6 things in there, it says well, typical sensitivity
7 analyses might vary the value of a parameter by a
8 factor of two, five or ten.

9 I've seen reviews where staff has come
10 back and said, you didn't vary it by two, five or ten.
11 That's according to this guidance you have to do that
12 for an acceptable sensitivity analysis. You know, I
13 could set a beta factor to 1.0, that would really make
14 every common cause really, really important but it's
15 kind of silly.

16 MS. DROUIN: Yes.

17 CHAIR STETKAR: So just by saying that
18 people typically do these things without instilling a
19 notion that you ought to, as part of that process, at
20 least express some measure of confidence in whether a
21 factor of ten, in that particular example, makes any
22 sense. Or 1.0 for a beta factor for common cause,
23 makes any sense.

24 MS. DROUIN: I agree, some intelligence
25 has to be put into the process when they're choosing

1 what they decide to do on their sensitivities.

2 CHAIR STETKAR: But as we evolve into
3 more, I hate to use the term prescriptive, but kind of
4 tighter guidance about how this is done people
5 naturally tend to just follow the written word and
6 interpret that as necessary and sufficient.

7 MS. DROUIN: I appreciate your concern.

8 CHAIR STETKAR: I'm sorry.

9 MR. DINSMORE: Yes, this is Steve
10 Dinsmore. Just in practice what would happen is if
11 one of these issues comes up, for example human
12 reliability, during an application we'll ask them to
13 do a sensitivity study. If it's less than the
14 acceptance guidelines everybody's fairly happy. If
15 it's above the acceptance guidelines we might not
16 accept the, we might.

17 So it becomes kind of a decision. It's
18 not well it's a 30 percent it's above and 60 below,
19 it's simply well you're not going to get 14 days
20 you're going to get ten. Because ten will work. And
21 that's kind of where it ends.

22 CHAIR STETKAR: Except for the fact people
23 then start to game the system.

24 MR. DINSMORE: Well I guess that's why
25 we're there. They could, but once the process has

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1 started, once the issue has arisen and then the way it
2 ends up is there's a final decision whether to okay or
3 not.

4 MS. DROUIN: No, I mean there's a fine
5 balance in writing a guidance document that you don't
6 want to become so prescriptive that the people stop
7 thinking and they use it as a checkmark.

8 CHAIR STETKAR: Right.

9 MS. DROUIN: And we don't want to do that.
10 And so hopefully we haven't erred on that side where
11 we thought we were so un-prescriptive that people had
12 no idea really how to apply it. So we've tried to add
13 enough clarification without going down that path.
14 And maybe we need to go back and add some more
15 caveats.

16 CHAIR STETKAR: Again, in the sense of
17 practicality I'm certainly not advocating the fact
18 that every type of model uncertainty you look at. Or
19 any type of range of sensitivity values that you put
20 in an analysis you do a formal Shack type process of
21 expert elicitation. That's obviously inappropriate.
22 But having the people who do that express at least
23 some degree of confidence could help, on both sides.

24 MS. DROUIN: Absolutely.

25 MR. WHEELER: Okay. Next slide. I think

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1 this discussion we just had relates to this slide
2 where we point out that we give guidance on both doing
3 conservative screening to give the analyst the option
4 of hopefully picking off some low hanging fruit
5 without having to worry about some of the issues we
6 just discussed. Or using realistic sensitivity
7 analyses where they are directed to develop
8 alternatives or hypothesis that are considered to be
9 reasonable.

10 And I'll just, again, I think we actually
11 have this sentence in the report somewhere and I'll
12 invoke some more wisdom from Garith Parry, where he
13 said, what is known about the issue itself will likely
14 dictate the possible alternatives that are defined and
15 studied. And I think that relates strongly to the
16 discussion of how much confidence do we have in
17 particular alternatives or hypothesis as to whether
18 they are strong candidates or perhaps lesser so.

19 MEMBER SCHULTZ: Now here the slide said
20 perform screening and sensitivity analysis. Earlier
21 you mentioned that you wanted that to be an or.

22 MR. WHEELER: Yes, and thank you. It
23 should be an or here to be consistent with how we
24 present this in the chapter. Thank you very much.
25 Next slide, Mary.

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1 So the guidance in Stage E is presented
2 within the context of what we call two significant
3 different cases for acceptance guidelines. Case one
4 being the single metric case. For example where the
5 acceptance guideline is an acceptable core damage
6 frequency guideline.

7 And then case two, we call that the
8 multiple risk metric case. For example, where we may
9 interested both in core damage frequency and the
10 change in core damage frequency. And an example of
11 this is Reg Guide 1.174. And then for each of those
12 two cases if you harken back to Step 1.3 where, again
13 consistent with the standard, you are characterizing
14 the model uncertainties we identify four different
15 categories or types of model uncertainties.

16 Those that affect a single basic event.
17 Those that affect multiple basic events. Those that
18 could potentially impact the structure of the PRA
19 model, either fault trees or event trees. And then
20 logical combinations of any of the above three. And
21 I think we also inherently understand combinations of
22 those but I just -- Next slide, Mary.

23 I just wanted to quickly discuss logical
24 combinations, and we did this in the NUREG because we
25 wanted to make sure the licensees were clear in what

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1 we meant. There can be multiple, model uncertainties
2 can often interact in a synergistic way when you
3 assemble your model together and this is what we're
4 calling logical combinations.

5 And an example of this might be what is
6 the importance of the high-pressure coolant injection
7 section in a BWR. AS you can see there are several
8 aspects of that where each one is potentially
9 individually a model uncertainty. And you could
10 model them individually and see how each one of them
11 effects the potential importance of the HPCI system.

12 But to really get a clear understanding,
13 or a comprehensive understanding of what might be the
14 potential impact of several model uncertainties on the
15 importance of the system you would have to coordinate
16 your sensitivity analyses so that you're looking at
17 them all together, not just individually and ignoring
18 any kind of synergistic effect.

19 Another example would be diesel generators
20 and failure to restore DGs before the batteries fail,
21 you could do a model that shows that as time goes out
22 you're going to approach the probability of successful
23 recovery of the diesel generators of 1, because given
24 enough time you'll restore those diesel generators.
25 But there's a competing situation going on here with

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1 the batteries.

2 And you're going to come to a point where,
3 after so much time, you'll no longer have the
4 batteries available to flash the diesels. So that's
5 another example. And the EPRI report has additional
6 examples as well. Next slide.

7 So in summary the content of Stage E is
8 presented, the guidance that's presented in these
9 eight different cases, four for each case according to
10 the four different categories that we had identified.

11 And I just want to state here that for all
12 the case one cases you might be doing a calculation,
13 for example for the single base basic event case that
14 lends itself to a risk achievement worth importance
15 measure comparison, you can compare it to some metric
16 that we call, for example, the maximum allowable risk
17 achievement worth.

18 The others don't lend themselves to risk
19 achievement worth measure but you would be quantifying
20 a new core damage frequency, for example, given the
21 sensitivity analysis that you've identified and
22 developed and comparing that to a maximum allowable
23 core damage frequency metric.

24 In the second case, where you have the two
25 metrics, you can see down at the bottom we give

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1 guidance to calculating two different pairs of numbers
2 that can be compared against the acceptance
3 guidelines. And example is NUREG 1.174, the second
4 one over shows the potential impact of the proposed
5 change in the application without any regard to the
6 potential impacts of uncertainty.

7 In the first one you would requantify the
8 base PRA and application PRA within the context of
9 your sensitivity analysis and come up with new metrics
10 for core damage frequency and for the delta core
11 damage frequency. So you're getting two different
12 perspectives against the acceptance criteria 1.174 as
13 to where you might be given the application.

14 And so just in conclusion. Stage E we
15 have identified any key model uncertainties and we
16 have an understanding of what is the potential impact
17 from the uncertainty associated with these key issues
18 and the extent to which we might be challenging or
19 exceeding the acceptance criteria. And the strategy
20 for what the applicant chooses to do with that is
21 discussed in Stage F.

22 MS. DROUIN: Okay, so we'll move on to
23 Stage F. And, as we said earlier, this is a whole new
24 chapter that's in the revision. And so Anders
25 Gilbertson is going to walk through this chapter.

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1 MR. GILBERTSON: Thank you, Mary. Good
2 afternoon, everyone. So Stage F is describing the
3 licensee application development process. The primary
4 objective of this stage is to provide guidance to the
5 licensee on the process of developing a risk-informed
6 application submittal as pertains to the treatment of
7 uncertainties.

8 The purpose of this guidance is to help
9 ensure that the licensee provides adequate
10 justification for the acceptability of the given risk-
11 informed application. Including the physical
12 documentation provided in the submittal. So this
13 stage consists of a set of options that can be used by
14 the licensee to determine whether adequate
15 justification has been provided.

16 And these stages include defining, or
17 redefining, the application. Refining the PRA
18 analysis or using compensatory measures or performance
19 monitoring requirements. And I'll go into more detail
20 on these in the next slides.

21 As Mary had mentioned, this is a new
22 section in the NUREG. Revision 0 of 1855 had brief
23 discussions throughout the document regarding the
24 determination of adequate justification for the
25 application submittal. However, it was generally

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1 unclear in many cases whether the guidance was
2 intended for the licensee or the staff.

3 So for this revision the stage
4 consolidates many of these discussion from the
5 previous revision to help provide clear guidance to
6 the licensee on the staff expectations regarding the
7 licensee's justification of an application. Next
8 slide.

9 So this figure illustrates the
10 relationship of the licensee application development
11 process, shown here as Stage F, to the overall
12 uncertainty assessment process. Stage F is
13 represented on the right, by the blue box, and it
14 consists of the three options, as had mentioned
15 previously, that the licensee may use to develop their
16 risk-informed application.

17 During the application development process
18 these three options may be used alone or together and
19 to varying degrees, depending on the needs of the
20 application. Further, as has been mentioned I think
21 a couple of times already this afternoon, the
22 application development process is generally performed
23 in an iterative fashion so as is meant to be expressed
24 here by directional arrow between the assessment of
25 uncertainties and Stage F, there.

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1 So, for example, after either the first
2 two options, the redefine the application or refine
3 the PRA, after either of those two have been performed
4 the licensee should revisit the assessment uncertainty
5 process to reassess the impact of uncertainties
6 following any changes to the application or the PRA
7 model. Next slide, please.

8 So when an application does not adequately
9 cover significant risk contributors licensee may
10 choose to redefine the application. For example, the
11 scope of the application could be restricted only to
12 those parts that are supported by the risk assessment.

13 So if the PRA model does not address fire
14 hazards the change to the plant could be limited such
15 that any structures, systems or components used to
16 mitigate the risk from fires would be unaffected. In
17 this way the contribution to the overall risk from the
18 internal fires would be unchanged.

19 If the application is redefined the
20 licensee should go back to Stage B and determine if
21 the scope and level of detail is sufficient and
22 appropriate for the redefined application.
23 Subsequently the licensee would enter back into the
24 uncertainty assessment process to determine the impact
25 on the uncertainties. Next slide, please.

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1 So the second option, refining the PRA.
2 So if the risk metrics challenge or exceed the
3 application acceptance guidelines the licensee may
4 choose to refine the application PRA so as to reduce
5 the risk. After refining the application PRA the
6 licensee should recalculate the risk metrics by
7 performing, going back through Stage D, and reassess
8 the impact of parameter uncertainties on the refined
9 PRA.

10 The licensee should also reassess the
11 impact of model uncertainties, via Stage E, to
12 determine the impact of the existing model
13 uncertainties as well as any new model uncertainties
14 that may have been introduced. Next slide, please.

15 MS. DROUIN: And also I might add that
16 refining the PRA could also come as an outcome where
17 his scope and level of detail is insufficient. And so
18 he may then decide to update his PRA to expand it to
19 include the necessary scope and level of detail. I
20 mean he'd still go through these same steps.

21 MR. GILBERTSON: Okay. And finally, the
22 licensee may choose to provide justification for any
23 challenge to or exceedance of the application
24 acceptance guidelines via the implementation of
25 compensatory measures and/or performance monitoring

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1 requirements. So by using compensatory measures the
2 licensee essentially tries to eliminate the negative
3 impact of some feature of the plant design or
4 operation on the plant risk.

5 For example, a fire watch may be
6 established to compensate for some weakness that's
7 been identified in the fire PRA, such as a faulty fire
8 barrier or a temporary removal of a fire barrier.

9 The performance monitoring is used to show
10 there's no degradation in some aspects of plant
11 performance that is expected to be affected by the
12 application. So for performance monitoring to be
13 effective the affected aspect of plant performance
14 must be measurable in some quantitative fashion. And
15 the guidelines used to assess the acceptability of the
16 performance should be realistically achievable given
17 the quantity of data that might be generated. Next
18 slide, please.

19 So in preparing the application submittal
20 the licensee is responsible for ensuring that the
21 application is adequately justified and that the
22 conclusions of the risk assessment are communicated
23 clearly and concisely. So the concept illustrated
24 here in the figure, is that the amount of
25 justification needed for a particular application

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1 depends directly on the proximity of the risk metrics
2 to challenge as would be expressed in Regime 3, or an
3 exceedance, such as in Regime 4 of the application
4 acceptance guidelines.

5 I just wanted to introduce this figure
6 here. Steve Dinsmore will speak more about it in his
7 section on Stage G. Next slide, please.

8 So in preparing the application submittal,
9 with regard to the licensee's justification of an
10 application the staff expects that the licensee will
11 communicate clear understanding of the risk
12 contributors as well as their impact on the results.
13 Make sure that the model uncertainties have been
14 accounted for using the techniques in Stage E. And
15 the model has sufficient scope and level of detail to
16 support the conclusions of the analysis, using the
17 guidance from Stage C of this report.

18 Additionally, licensee may need to include
19 additional discussion in the submittal to address
20 aggregation of risk results, depending on the
21 application. Next slide, please.

22 And, finally, the documentation needed for
23 an application should be commensurate with the
24 proximity of the risk results to the acceptance
25 guidelines. So similar to the relationship between

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1 the justification needed and the proximity to the
2 guidelines documentation should be commensurate with
3 that need.

4 So that is to say that as the risk metrics
5 come closer to the challenging or exceeding the
6 application acceptance guidelines the greater the
7 justification will be needed as well as the
8 documentation supporting the argument for adequate
9 justification.

10 And so 1855 includes several elements of
11 the documentation that staff expects to be included in
12 the application submittal, including for example, a
13 description of the acceptance guidelines used for
14 comparison. A discussion of the impact of parameter
15 uncertainty, relevant source of model uncertainty and
16 the impact on the results. And a description of
17 significant modeling conservatisms.

18 MS. DROUIN: And optimisms.

19 MR. GILBERTSON: Yes.

20 CHAIR STETKAR: I'm going to wait for
21 Steve.

22 MEMBER SCHULTZ: I don't know how much I'd
23 emphasize that first bullet, the amount and quality of
24 the documentation. I just recommend caution there
25 with the selection of those words. Especially the

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1 amount of the documentation. I could certainly see
2 some areas where you'd want to have very good
3 documentation, even if you're not near the acceptance
4 guidelines. It's just going to be case dependant and
5 so giving leeway to less documentation, either in
6 amount or quality, I'm not sure I would go very far in
7 that direction.

8 MS. DROUIN: Okay.

9 MR. GILBERTSON: Okay.

10 MEMBER BLEY: I guess that's worth a
11 little talking about. The general concept that the
12 closer you are to trouble the more convincing the case
13 sort of makes sense. On the other hand, if you're far
14 away because of poor work you don't document well
15 you've missed out. So that's where you're coming
16 from?

17 MEMBER SCHULTZ: That's where I'm coming
18 from.

19 MEMBER BLEY: And amount's probably not a
20 crucial thing anyway, it's the quality. But even if
21 you're far away, if the quality if not good maybe
22 you're not so far away.

23 CHAIR STETKAR: We might as well follow
24 up, because I was going to hit Steve with that.
25 Because the guidance to the staff mirrors this. It

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1 says you need to look really closely at things that
2 are close to the margin. You don't need to look very
3 carefully at things that are way away from the
4 margins.

5 So if I make up a number and say that a
6 pump fails at 10^{-20} per hour so therefore it can be out
7 of service forever. Well I'm way away from the
8 margin, the staff doesn't need to look at that. And
9 I wrote a report, I had a number in it. I did some
10 sensitivity calculations around that number. I
11 increased it all the way to 10^{-16} .

12 MR. DINSMORE: Well we've seen numbers
13 like that with some pipe ruptures, but not with pump
14 failures.

15 CHAIR STETKAR: I've seen valve failures
16 in other countries that have numbers like that. In a
17 sense the point is, regardless of what the guidance to
18 the applicant might be, it would seem that the
19 guidance to the staff should be that you really need
20 to think about the quality of the analysis that
21 justify very large margins just as much as the quality
22 of the analysis that just squeak by.

23 In fact, in many cases it's more important
24 to worry about the quality of the analyses that show
25 larger margins because applicant naturally is going to

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1 fine tune their numbers and sharpen their pencils and
2 do whatever they can to show that they come in at 9.99
3 instead of ten.

4 MR. DINSMORE: Most of the applications
5 that we've dealt with to date, for example risk-
6 informed ISI and those type of things are either we
7 generally kind of agree that the risks are relatively
8 low or it's an AOT extension or something which is
9 fairly well defined so that we can kind of hone in.
10 And if they make an assumption like that, and they're
11 supposed to report that type of assumption, and we
12 would review that and pursue it on a case-by-case
13 basis.

14 We've had less experience with plant-wide
15 stuff, which probably the fire and stuff is the first
16 time we've had plant-wide --

17 CHAIR STETKAR: Fire stuff and there's at
18 least one new reactor applicant that's going to come
19 in with a set of risk-informed tech specs.

20 MR. DINSMORE: We'll like there's on pilot
21 coming in with 50.69 and the tech specs, yes. But we
22 haven't crossed that bridge yet so --

23 CHAIR STETKAR: Okay, but you know it's
24 coming.

25 MR. DINSMORE: Yes.

1 MS. DROUIN: I think that there's two
2 kinds of documentation. And the emphasis here has
3 been on the documentation of your justification of
4 your results versus the documentation to show that you
5 have a technically adequate or technically acceptable
6 analysis. And I think when you're talking about
7 whether or not the analysis they did is technically
8 acceptable they have to prove that whether they're far
9 away, because you want to make sure that they truly
10 are where they are. Or whether they're challenging.

11 Now, how much justification they have to
12 provide in terms of once you know then that is going
13 to be, from my understanding from NRR, and Steve
14 please correct me, is now going to depend really how
15 close you are. And that's just being pragmatic.

16 I mean if somebody comes in and they're a
17 good order magnitude away, you know you just aren't
18 going to devote the same resources and the same level
19 of detail into the review as you would with somebody
20 who comes in and they're challenging or exceeding the
21 guidelines. In both cases you want to have good
22 confidence that the analysis was performed correctly.

23 MEMBER SCHULTZ: Yes, that added
24 clarification helped a lot. I didn't take that from
25 this bullet.

1 MS. DROUIN: No, you're right. That
2 wasn't explained well enough. And a lot of that is
3 relying on the peer review. And so you may go into
4 more depth on the peer review when you're closer to
5 the guidelines and not go so much into so much depth
6 when you're real far away from the guidelines.
7 Because you're relying on the peer review to have done
8 its job.

9 MR. DINSMORE: Yes, that's exactly right.
10 That's how we do it.

11 MEMBER BLEY: This kind of gets us back to
12 where Mr. Stetkar began the day a little bit too. And
13 that's that mean value issue. You know, you've got a
14 location estimate and uncertainty estimate. For the
15 same mean value for a particular decision it's
16 possible in one case that there's essentially zero
17 probability that you exceed whatever the criteria is.

18 And in a second case, for the same mean
19 value, there might be as much as a 30 percent chance
20 that you exceed that criteria. And to treat those as
21 identical seems not in the spirit of what we're doing
22 here and it bothers me. And John pointed out the
23 language, which I didn't remember in 1.174 that kind
24 of covers that.

25 In a lot of cases perhaps the error

1 factors are similar on a lot of things, but in some
2 cases they're quite broad and when that happens you
3 can have a fair chance that you're going to operate
4 outside of where you think you're going to be. That
5 one just bothers me a bit. We'll leave it there for
6 now.

7 MR. DINSMORE: Yes, 174 says quite clearly
8 that we use the mean value.

9 MEMBER BLEY: It does. But then, and,
10 John, you remember the words. I forget what the words
11 are but with due consideration of --

12 MR. DINSMORE: Uncertainty.

13 MEMBER BLEY: Something like that.

14 MR. DINSMORE: Well we do that by pursuing
15 the technical adequacy of the PRA with more vigor, as
16 Mary was saying, as we get closer.

17 MEMBER BLEY: And in most cases you look
18 at your uncertainty bounds are relatively similar. In
19 some cases they're quite extreme. To treat the same
20 doesn't seem in the spirit of 1.174 or in the spirit
21 of what I think we ought to be doing here. In those
22 cases where we've got a 30 or 40 percent chance of
23 being outside of whatever the criteria is, to treat
24 that the same as the chance where we're almost
25 guaranteed not to, doesn't seem to make sense to me.

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1 MR. DINSMORE: Yes. Well if they'd use an
2 odd method, noted by the peer review as being odd, and
3 they came in --

4 MEMBER BLEY: I'm not talking about
5 methods. I'm talking about a case where you've really
6 got a lot of uncertainty. As opposed to the normal
7 case where your uncertainty isn't so extreme. It's
8 independent of method. It's the real world's out
9 there and we have uncertainty about it. Anyway let's
10 go ahead. But that's, the logic just doesn't seem to
11 work for me. Essentially because I've spent time
12 working in how you address those cases and how you get
13 out of that situation. They're very different cases.

14 MEMBER SHACK: But that seems like a 1.174
15 issue. I mean that's how do you make the decision in
16 that case.

17 MEMBER BLEY: Oh, I think it is.

18 MEMBER SHACK: You know if you come to
19 this conclusion --

20 MEMBER BLEY: But I think 1.174 has a
21 softness to it to say --

22 MEMBER SHACK: But I think 1.174 says that
23 -- Well I mean, mean is what you look at for the delta
24 CDF but that's not the only thing that goes into the
25 decision.

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1 CHAIR STETKAR: Well but if the guidance
2 doesn't capture the notion that you ought to be
3 producing the information. And if the guidance to the
4 reviewer doesn't say that you ought to be looking for
5 that information, then you're left with sort of vague
6 terms in 1.174 and people saying well this NUREG, or
7 the associated ISGs clarified that vagueness and we
8 don't have to look at it.

9 MS. DROUIN: Okay. Steve, you're on.

10 MR. DINSMORE: Okay. My name is Steve
11 Dinsmor, I'm a Senior Risk and Reliability Risk
12 Analyst in the NRR, PRA licensing branch. As Mary
13 indicated earlier Donnie Harrison and Andy Howe did
14 most of this work. I only recently got involved so
15 I'll try to do justice to this topic.

16 The objective of Stage G, which I guess is
17 a new stage in this report. They're all new stages.
18 See I'm going to be learning a lot in here. It's to
19 describe the process used by the staff to determine
20 whether a licensee's risk-informed application
21 demonstrates and acceptable treatment of uncertainties
22 and that the proposed application represents and
23 acceptable risk impact to the plant.

24 Then that next bullet, that little dark,
25 oh it's green on that. The green is the one that

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1 means something in general, more justification will be
2 needed for a given application when the risk results
3 are closer to challenging or exceeding the acceptance
4 guidelines than when the risk results are farther
5 away. And I'll provide you with specific examples of
6 how that process works later.

7 In determining whether acceptance
8 guidelines have been met we look at how do the risk
9 results compare to the guidelines. Is the scope and
10 level of detail of the PRA appropriate. Is the PRA
11 model technically adequate. Is the acceptability of
12 the application adequately justified? And then we're
13 going to address through discussing completeness
14 review, parameter review, model uncertainty review,
15 which are the following slides. Next slide.

16 Changes to the NUREG about the staff
17 review process. This section has been almost
18 completely revised. Previous versions are written by
19 discussing issues that either the licensee or the
20 staff needed to address. It wasn't clear whether the
21 discussion was guidance for the licensee or the staff.
22 The approach that is taken by the staff is laid out in
23 this version. As well as the decision criteria.

24 Let me answer just quickly the question
25 about how this process described in G compares with

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1 our current review process, which follows the SRP and
2 the Reg Guides. Effectively it just kind of is a
3 collection of best practices that put stuff into the
4 framework. So it just describes what we're currently
5 doing. Next slide.

6 Completeness review. The staff will
7 assess whether the following criteria are met. The
8 PRA scope and the level of detail and the licensee's
9 use of any screening analyses are appropriate. The
10 base PRA and changes to the PRA that are used to
11 support the application are technically adequate.

12 Now as Mary indicated earlier the way we
13 do that is we, according to the Reg Guides and the
14 SRP, we use the results peer review. We rely very
15 heavily on those. As is a general measure of
16 technical adequacy. Then if the licensee does not
17 provide adequate justification for the exclusion of
18 the missing PRA scope and level of detailed items,
19 e.g., the licensee provides insufficient justification
20 to show no impact from seismic, the staff will
21 typically reject the licensee's risk-informed
22 application.

23 This has come up somewhat recently,
24 because fires are now, in Reg Guide Rev 2, which is
25 more than one year old so it's now applicable. So we

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1 have actually started, or have turned back some
2 applications, because they do not have a fire PRA.
3 Because they don't have a fire PRA and they can't
4 demonstrate that the proposed change won't affect the
5 fires. So this has come up mostly with fires.

6 An example of stuff that you can still do
7 is if you want to move heavy loads and you're doing it
8 for 18 hours and you don't have a seismic PRA and you
9 could say well the likelihood of having a seismic
10 event that exceeds the safe shutdown, the earthquake
11 which I can show, won't drop my heavy load within 18
12 hours is very small. That's the kind of stuff that we
13 can still accept.

14 The last one, if the staff determines
15 there is a technical inadequacy we typically reject.
16 Okay. Next slide.

17 Parameter review. We determine whether
18 acceptable justification is provided for the
19 acceptability of the risk results compared to the
20 acceptance guidelines. There's lot of acceptance in
21 there. The staff looks at the relevant risk measures
22 usually expressed as a mean value or a point estimate.
23 Always expressed as either a mean value or a point
24 estimate. If they don't deliver we don't request.
25 And I don't think, we could request but we don't

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1 normally request uncertainty numbers or distributions.

2 The acceptance guidelines used for a
3 particular application, there's several of those. The
4 most common are delta CDF and LERF. If inadequate
5 justification the staff will typically reject.
6 Usually, typically what will happen is there will be
7 some back and forth and they will either improve the
8 analyses or change the request.

9 Model uncertainty review. The staff
10 determines whether there is adequate treatment of the
11 model uncertainties by the licensee. Staff determines
12 if the key sources of uncertainty are appropriately
13 identified or whether they were adequately
14 characterized and their impact evaluated. If they're
15 not appropriately identified or treated, will
16 typically reject the licensee's application.

17 This is sometimes straight-forward. There
18 was the example earlier about the diesel generator
19 ALT, extending that. The time to recover offsite
20 power is probably a key assumption in that and we'd
21 look at that. Regardless of what the peer review
22 said, we would always look at what the peer review
23 says. But sometimes we will look at stuff that the
24 peer review did not discuss. Although that's --

25 CHAIR STETKAR: Does that question your

1 confidence in the peer review, Steve?

2 MR. DINSMORE: No.

3 CHAIR STETKAR: Okay. I'm going to
4 question why.

5 MR. DINSMORE: Well it's we want to be
6 able to demonstrate as well, that we've done our job
7 properly.

8 CHAIR STETKAR: Absolutely.

9 MR. DINSMORE: And so that's one of the
10 ways we do that. Modeling uncertainty is becoming a
11 larger issue in fire PRAs and I'm sure you're going to
12 hear a lot about that, I guess next month. It's an
13 issue that we haven't quite figured out how to work
14 our way through the real complicated applications.
15 Next slide.

16 Steps in the overall review. Well we'll
17 typically begin with a technical adequacy check and
18 comparison of application risk results to the
19 application specific acceptance guidelines.
20 Justification provided by the licensee is dependant on
21 the significance of the risk results. We got regime
22 -- You guys use complicated words. I might slip up
23 and say region occasionally.

24 Regime 1, if the risk results are well
25 below the acceptance guidelines. 2, they're closer.

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1 3, they're challenged. 4, they're above. If we go to
2 the next page which is this wonderful graph. This
3 graphically illustrates these regimes. And as we move
4 up through the regimes, that's from left to right, the
5 quantitative estimates become more important. So the
6 uncertainties in this estimate also becomes more
7 important.

8 174 says to use mean values. So the way
9 we use uncertainty is by increased attention to the
10 PRA model. So if you're far enough down there in
11 Regime 1 the conclusion is that you'd have to have
12 pretty severe errors in your model or there would have
13 to be a whole lot of uncertainty to push you up over
14 the acceptance criteria. But as you move on up you
15 pay much more attention to what was modeled in the
16 PRA.

17 MEMBER SCHULTZ: Just a clarification
18 here. I agree with this pictorial of the way in which
19 justification is needed, but I don't much, to my
20 previous comment on documentation, I don't correlate
21 documentation with justification. The quality and the
22 quantity of documentation doesn't necessarily match up
23 with the justification.

24 MS. DROUIN: And we agree.

25 MEMBER SCHULTZ: The documentation quality

1 and the amount that needs to be provided doesn't
2 necessarily line up with the justification.

3 MS. DROUIN: We're not trying to imply
4 that if you were, for example in Regime 1, you only
5 had to do a five-page submittal. Whereas if in Regime
6 4 you had to give a 25-page submittal. No we aren't
7 trying to --

8 MEMBER SCHULTZ: That's fine. I
9 understand. But that's what I wanted to clarify.

10 MS. DROUIN: And so we can clarify that.

11 MR. DINSMORE: Okay, next slide. So now
12 we're going to talk about each regime, one at a time.

13 Regime 1, a good example of that is risk-
14 informed ISI. The risk results are well below the
15 acceptance guidelines. The staff would review the
16 peer review findings of the licensee's PRA to identify
17 any findings of particular relevance. For example,
18 I'm going to use some terminology here, if you guys
19 want explanation just ask.

20 We'd probably only request that there was
21 any unresolved findings for supporting requirements
22 that are relevant to the application. The peer review
23 does their thing and they come up with all these
24 findings for these supporting requirements and then
25 the licensee looks at them and they fix them or they

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1 say why it's not important.

2 So for these type of applications we
3 probably only requested that if there was any of those
4 that are important, that have not been resolved yet.
5 The staff would look for qualitative or quantitative
6 state-of-knowledge correlation showing it does not
7 effect the PRA.

8 Regime 1 continue on the next page. We'd
9 look to determine whether the validity of the
10 assumptions made in the application PRA will be
11 appropriately monitored and whether degraded
12 performance can be detected in a timely fashion. For
13 example, with one of these type of applications we
14 might just accept that the Maintenance Rule can be
15 relied on to monitor any unexpected increases on
16 availability.

17 Finally, we would not generally perform an
18 audit of the application PRA.

19 CHAIR STETKAR: So they could have a bunch
20 of and gates in there instead of or gates and we would
21 never look at that?

22 MR. DINSMORE: If the PRA peer review --

23 CHAIR STETKAR: You would rely on the peer
24 review to find that?

25 MR. DINSMORE: Yes, we would rely on the

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1 peer review to identify those type of difficulties.

2 CHAIR STETKAR: Okay.

3 MR. DINSMORE: If the peer review --

4 CHAIR STETKAR: And you expect to see
5 those in the peer review findings that you need to
6 look at?

7 MR. DINSMORE: Yes. Because what the peer
8 review would do is they'd say that they found that.
9 And then the licensee would fix it and then they'd say
10 they fixed it. So there would be that trail.

11 CHAIR STETKAR: So it would be visible.
12 Okay.

13 MR. DINSMORE: Then Regime 2. These
14 things are kind of the same. Regime 2, the risk
15 results are close by an order of magnitude the staff
16 would examine the peer review findings with a higher
17 degree of scrutiny. That's the difference. For
18 example we might request all unresolved findings. And
19 any resolved findings for important supporting
20 requirements.

21 We'd also look for quantitative assessment
22 of the state-of-knowledge correlation. The staff
23 would examine the application to ensure that the
24 proposed performance monitoring is appropriate. For
25 example, we might request a description of the program

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1 and how it includes appropriate feedback in this case.
2 Where in Regime 1 we might have relied more on the
3 Maintenance Rule.

4 In general the staff is unlikely to
5 perform an audit of an PRA application which fall into
6 this regime. Unless there's a lot of problems.
7 Unless the peer review found a lot of problems and the
8 licensee says well, we fixed them all. But if there
9 were a lot sometimes we go audit anyway. And a good
10 example of this regime are AOT extensions for
11 individual SSCs. That's what we've seen a lot in this
12 area. They might be up to the 10^{-5} .

13 Regime 3. This is the one that's more
14 challenging. Can be right up to the guidelines or
15 maybe even over. These would be risk-informed
16 surveillance frequency changes. For example 4-B,
17 which goes to a plant-wide risk-informed AOTs. Or
18 NFPA 805, so these are much more challenging. So the
19 risk result's challenged but do not significantly
20 exceed.

21 In this case the staff would examine the
22 peer review finding with an even higher degree of
23 scrutiny. For example, for the fire stuff we're
24 requesting findings on all supporting requirements and
25 which supporting requirements for Capability Category

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1 1 and so on and so forth. So we get a lot more
2 information about the quality of the PRA. We would
3 look for quantitative assessment of the state-of-
4 knowledge correlations which shows that it does not
5 impact the results.

6 The staff would examine the application to
7 ensure that the proposed performance monitoring is
8 appropriate and adequate. In this case we might
9 request a detailed description of the monitoring
10 program, including how guideline values are selected
11 and used and the procedures which they're going to use
12 and so and so forth.

13 Then a new one would be applications in
14 this regime would likely identify compensatory
15 measures. Especially if they're going to bump up over
16 the acceptance guidelines. We'd probably want them to
17 give us some information about how they'd deal in that
18 situation.

19 In general it is likely the staff would
20 perform an audit of the application. So we'd take all
21 the peer review results and we'd go through them and
22 then we'd go down and we'd look at that PRA.

23 Regime 4, results clearly exceed the
24 acceptance guidelines. You might wonder why this is
25 even here. Actually it's the fourth bullet that this

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1 pops up. If it's part of a combined change request
2 one aspect exceeds the guidelines while another aspect
3 makes the overall risk results acceptable. So part of
4 it's regime is above and they're offsetting it.

5 The best example of that is we had
6 somebody came in and wanted a diesel generator AOT
7 extension. They couldn't meet the guidelines unless
8 they credited black start of an off-site gas turbine.
9 So they proposed both changes at the same time. And
10 then what we do is we determine the appropriateness of
11 being combined. So these are both electrical stuff so
12 they're fairly consistent, the appropriateness of the
13 compensatory measures and we'd perform a more in-depth
14 audit of the application PRA.

15 This also pops up in fires. There's also
16 a lot of off-setting risk calculations in fires. And
17 actually that's pretty much it. If accepted by the
18 staff the risk-informed application is considered to
19 have an acceptable treatment of uncertainties,
20 reflected by our more detailed or appropriate review
21 of the technical adequacy of their PRA.

22 And to meet the fourth risk-informed
23 decision making principle, mainly just by comparing
24 the acceptance guidelines with the results.
25 Conversely if the staff rejects the application it's

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1 considered unacceptable.

2 We actually, to reject and application we
3 have to demonstrate that it's unacceptable. Or we
4 have to describe exactly why.

5 MEMBER SHACK: But you're always right in
6 either case.

7 MR. DINSMORE: We have the final say.

8 MS. DROUIN: Okay. And I don't know if
9 we're -- I'm sorry.

10 CHAIR STETKAR: Mary, we're almost
11 definitely going to run over time. Mary, do you have
12 any problems with your travel schedule or anything?

13 MS. DROUIN: No.

14 CHAIR STETKAR: All right, I just wanted
15 to check.

16 MS. DROUIN: I didn't know if you, the
17 next part of the presentation is going through
18 Appendix A. You know, now nothing has changed in
19 Appendix A. So we had just put together a couple of
20 slides and John was going to walk through, but if you
21 want us to skip it we have no problem with skipping
22 that part of the presentation.

23 CHAIR STETKAR: I don't want to skip
24 discussion of Appendix A. It depends on what the
25 other members prefer, whether they want to go through

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1 the slides. I had several comments on the example, on
2 specific examples from Appendix A that I wanted to
3 raise kind of questions about. You know, they don't
4 address anything that's in the slides, but they're
5 examples. So should we go through the slides or
6 should we just -- Let me just --

7 MEMBER RYAN: Just jump right to the
8 question.

9 CHAIR STETKAR: Let me do that. And most
10 of the examples that I'd like to address, and I'll try
11 to be judicious about selecting these things here. My
12 concern is that it's a well presented example that
13 sort of walks through the whole thought process. It's
14 really useful.

15 The problems that I have is that people
16 reading this document will look at that example and
17 read what people have done in that particular example.
18 Regardless of the little footnotes that you have
19 throughout the document that says, warning, warning,
20 warning, this is a very specific, plant specific,
21 example. It may not apply anywhere else. They will
22 still read what was done and say, ah, the NRC will
23 accept this type of thought process. And let me give
24 you a few examples.

25 With regard to the scope of the risk

1 assessment in Table A-3, it's essentially concluded
2 that external floods are not relevant to the AOT
3 analyses because "they are a slow developing event
4 which would allow restoration of out of service RHR
5 loops prior to presenting a significant challenge."
6 That's the justification.

7 Now there are a bunch of things in that
8 simple quote that presumes that people will always be
9 successful in doing whatever needs to be done within
10 whatever available time window is presented by any
11 possible external flood from any possible source.
12 That's what that says.

13 Well, I don't know about this particular
14 plant. Maybe it's not downstream from a dam. Maybe
15 it's not on a coast that's susceptible to tsunamis.
16 I don't know anything about this plant, it's a made up
17 plant. It's actually a made up plant, it's Boiling
18 Water Reactor. A two-loop Boiling Water Reactor. Or
19 two safety train Boiling Water Reactor.

20 More troubling is that the reason that the
21 folks are proposing to do this particular extension of
22 the AOT is to perform preventive maintenance during
23 power operation, instead of during shut-down. A lot
24 of times when people do that kind of preventive
25 maintenance you, for example, disassemble pumps and

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1 valves and power supplies.

2 So they're lying around on the floor all
3 apart in pieces. Getting all of the pieces back
4 together again into something that might work might
5 take an awful lot longer than whatever you're
6 presuming is the normal maintenance on the RHR loop.
7 That you're taking credit for people getting back into
8 service before the flood hits your site.

9 So the question is well, as an applicant
10 can I make these kind of glib statements about, well
11 there's always enough time for me to do whatever I
12 need to get done without doing any type of an
13 assessment. I didn't see any assessment in there that
14 says we're not susceptible to rapidly developing
15 floods because A, B, C, D. We have enough time at our
16 site even to build a new pump and machine new little
17 parts for that pump, given whatever warning we have.

18 We have in place warning systems so that
19 everybody who runs the lakes or the rivers or whatever
20 they run will tell us that indeed the flood is coming.
21 Some plants do. Some plants don't. I don't see any
22 of that justification there. And that kind of goes
23 back to Steve's notion of is it adequate to simply put
24 a box on the table and say we had enough time so we
25 don't need to do this?

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1 MS. DROUIN: So you would feel better if
2 we added some more explanation there, not providing
3 all of the justifications because this then would just
4 impede. But at least acknowledge that there was
5 adequate justification or analyses done to support
6 this.

7 MEMBER SHACK: You have a Note 1 now that
8 says that there was analysis supporting these
9 conclusion and Tier 2 information.

10 CHAIR STETKAR: Yes, for the baseline PRA
11 though.

12 MEMBER SHACK: Well it's Table A-3 note.

13 CHAIR STETKAR: Yes.

14 MEMBER SHACK: So I assumed that they're
15 talking about the basis, I mean that was my assumption
16 when I read it. But --

17 CHAIR STETKAR: Okay. If that's what that
18 means I'd certainly bring that up front, because it's
19 --

20 MEMBER SHACK: Obviously you can have all
21 the analysis there, but that's sort of what I
22 interpreted it to mean.

23 CHAIR STETKAR: Okay. If that's the case,
24 I mean if that's the interpretation of that.

25 MEMBER SHACK: Maybe typically it's not

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1 the words you want to use. That will be included in
2 terms of, you know, and address the application
3 specific.

4 MS. DROUIN: Yes.

5 CHAIR STETKAR: Because just saying that
6 in the baseline PRA they did an analysis that says,
7 well under typical maintenance configurations we could
8 rack a breaker back in and open a few valves, that's
9 one thing. Reassembling a pump, in the context of
10 this particular application, might be much different.
11 So sort of reenforcing that notion that that level of
12 justification needs to be provided before you just
13 qualitatively toss things away.

14 Another example, and again if it's
15 inferred that the documentation is there. But this
16 one's a little bit different. When they talk about
17 accidents at nearby facilities or transportation
18 accidents or releases of chemicals on-site. They
19 justify saying RHR is not a significant system in
20 mitigating accidents from nearby facilities. The
21 potential increase in risk impact is dominated by
22 potential effects of toxic gases on the operators.

23 You're looking at the change in risk here
24 from an allowed outage time on an RHR train. You're
25 not looking at the change in risk due to a toxic gas

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1 release. Now toxic gas release was in the baseline
2 PRA. Now toxic gas release, in most plants, look like
3 a transient. RHR has been shown to be important in
4 terms of transients.

5 So just saying that, and I have a little
6 calculation, that the delta risk from having the RHR
7 train out of service, the conditional change in risk
8 is exactly the same whether you have a toxic gas
9 release that kills the operators at point one. Or
10 whether you have some other transient with the
11 operators not available at point one.

12 Delta risk is exactly the same from having
13 that train out of service. I don't know what the
14 frequency of the toxic gas release is, but this
15 argument isn't made like some of the other ones that
16 say gee, I can't get an avalanche in the middle of the
17 desert. This one just says toxic gas release will
18 affect the operators. Well that's true, but it
19 affected the operators in the baseline PRA.

20 MEMBER SHACK: I mean that might need
21 clarification.

22 CHAIR STETKAR: That is not a logically
23 relevant justification for screening out those types
24 of issues. Because the delta risk doesn't depend on
25 the effect of toxic gas on the operators. We're not

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1 looking at delta risk toxic gas versus no toxic gas.
2 And those affect the screening of nearby facility
3 accidents, toxic chemical releases from transportation
4 and on-site types of toxic gas releases. So I'd urge
5 you to kind of look at that one.

6 MS. DROUIN: I mean we will go through and
7 try and do a real good scrubbing. Now this is one
8 where we'll do it with EPRI, because they were the
9 main authors behind those.

10 CHAIR STETKAR: Yes, that's a bit of my
11 concern. Kind of cycles back to is this a joint
12 EPRI/NRC or is this an NRC report. Or does the NRC
13 own these examples and this justification in this
14 appendix?

15 MS. DROUIN: Well we certainly listened to
16 EPRI on our report. And they do very detailed reviews
17 and we have lots of discussion. But ultimately we
18 make the final decision. And the same thing with
19 their report. But we have always been able to work
20 out everything to our mutual satisfaction.

21 CHAIR STETKAR: Okay. Let me ask, I guess
22 Anders or Steve, who's hidden behind the post again.
23 Wherever you are. One of the justifications, this is
24 on low power and shutdown. It says, "As will be shown
25 in Section A-5, the final at-power delta CDF and delta

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1 LERF results from Table A-7 for this application are
2 such that the results like in Region III of the Reg
3 Guide 1.174 acceptance guidelines and therefore it is
4 unnecessary to evaluate the low-power and shutdown
5 contribution to the base CDF and LERF."

6 Now the way I interpreted that is you are
7 in Region III meaning the delta CDF and delta LERF on
8 the vertical scale fall below that Region III line.
9 But Reg Guide 1.174 also has an absolute CDF and LERF
10 measure on the horizontal line. If the, for example,
11 CDF from low-power and shutdown were two times 10^{-4}
12 let's say, Reg Guide 1.174 would indicate that you
13 should not accept anything that increases the risk at
14 all.

15 Or let me put it way in the black or the
16 red or whatever color it is, 1.0×10^{-3} . So I'm
17 not sure why you don't have to make some sort of an
18 assessment of what the absolute core damage frequency
19 and large early release frequency from low-power and
20 shutdown might be to satisfy where you are on the
21 horizontal scale in that decision criteria.

22 MR. LEHNER: I'm trying to understand what
23 the question is. I mean you agree that moving the
24 maintenance, I mean the argument here is moving the
25 maintenance of the RHR from low-power shutdown to at-

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1 power, meaning that you're actually reducing the risk
2 at low-power shutdown.

3 CHAIR STETKAR: I don't know how much it's
4 reduced because I have no measure of what it was.

5 MR. LEHNER: Okay. So you're saying that,
6 as you've pointed out, that when you find that place
7 on the delta versus absolute CDF you should include
8 that low-power shutdown CDF --

9 CHAIR STETKAR: But this says I don't need
10 to estimate, this statement says I don't need to
11 estimate my, call it a baseline, core damage frequency
12 to low-power and shutdown because I'm in Region III on
13 the delta.

14 MR. LEHNER: Okay. You're saying that --

15 CHAIR STETKAR: I'm saying that if that
16 absolute core damage frequency were high enough, I
17 don't, you know, according to Reg Guide 1.174, I don't
18 care whether the delta CDF is 10^{-30} it's --

19 MR. DINSMORE: Yes, this is Steve. I
20 think actually, I'm assuming that Region III is less
21 than 10^{-6} delta CDF increase, in which case we don't
22 normally as them for the total, which is what that
23 sentence says which --

24 CHAIR STETKAR: Which is what that
25 sentence says, but that's not what Reg Guide 1.174

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1 says, Steve.

2 MR. DINSMORE: Well, it says that would
3 normally be acceptable unless we believe that the
4 total risk greatly exceeds 10^{-4} , is kind of how we've
5 interpreted it. And so if the risk, in general we
6 believe that the risks aren't real high. If the risks
7 were real high we would have known about it either
8 through the PRAs which have been done.

9 CHAIR STETKAR: These guys haven't done a
10 low-power and shutdown PRA. So they don't have a low-
11 power and shutdown PRA.

12 MR. DINSMORE: That's true.

13 CHAIR STETKAR: Their risk is anywhere
14 between 0 and 1.

15 MR. DINSMORE: Well the information that
16 we have available is that the risk from low-power and
17 shutdown added to the risk of the current operation
18 is, we don't believe that that's real high. We don't
19 believe it's high enough so that they should go and
20 make changes to their plant to reduce risk. So they'd
21 always have to reduce risk. If we did we'd get them
22 to make those changes. I think there's a certain
23 belief that the risks are, you know, they might around
24 10^{-4} and so on, but they're probably not a whole lot
25 higher. Even with the low-power and shutdown risk.

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1 And so when the total change in risk being
2 requested is less than 10^{-6} we normally don't ask them
3 for an estimate of their total, because we believe that
4 that answer would not change our review process.

5 CHAIR STETKAR: Okay. I'm not going to
6 belabor it anymore. I think I've made the point.

7 MS. DROUIN: And all I can promise is that
8 we will re-look at it and discuss it among ourselves,
9 but.

10 CHAIR STETKAR: Yes. There are a few
11 places and, where this term bounding assessment is
12 used. Most of the places where that term is used I
13 can easily show that it's not a bounding assessment.

14 MS. DROUIN: Okay. We will --

15 CHAIR STETKAR: Seismic in particular,
16 seismic with justification that taking out the main
17 condenser seismically induced transients and the same
18 basically applies for seismic loss of offsite power.
19 Basically says that we'll take the main condenser
20 away, but it presumes that all of the safety related
21 equipment still works, is never affected by a seismic
22 event.

23 It says well, we looked at the frequency
24 of these things and most of the frequency comes from
25 seismic events that are less than 0.3 g, I'll give you

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1 that. And a CLPF capacities for, I've forgotten, the
2 vast majority of seismically induced transient
3 frequency is less than that. High confidence for at
4 least one success path, high confidence of low
5 probability of seismic failure for at least one
6 success path of the events is greater than 0.3 g.

7 Well, suppose that's the RHR system,
8 suppose that the CLPF capacities of HPCI and RCIC on
9 this plant or any of these support systems are down in
10 the, I don't know pick a number, 0.4 g range. What
11 kind of risk do I get now from about 0.5 g
12 earthquakes, what's the frequency of those and how
13 sensitive are the results to increased on
14 unavailability of RHR?

15 Presuming of course that RHR isn't
16 completely failed by that earthquake, you know, so
17 there's a range of earthquakes where you where you
18 might be susceptible. This argument doesn't address
19 that at all. But it's called a bounding argument, it
20 can't be any worse than this, my god it can be a lot
21 worse than this.

22 MS. DROUIN: We'll do a word search on the
23 word bounding, everywhere in the appendix --

24 CHAIR STETKAR: Yes, just do that, that
25 might solve. Oh and one last question, and I don't

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1 know the plant, but some of these things and again in
2 particular, in terms of seismic events and to a
3 somewhat lesser extent LOCAs, I'm a bit confused about
4 what the conditional probability of early containment
5 failure is given the damage scenarios. Because as I
6 look at the analysis there seems to be some
7 disconnect. Either some failures of containment heat
8 removal are being assigned to something called a late
9 large containment failure, which obviously isn't
10 addressed here or I'm missing something.

11 Again, in particular for example, I know
12 they take credit for CRD injection from the condensate
13 storage tank, decent sized earthquake condensate
14 storage tank isn't going to look like a puddle on the
15 ground. They take credit I think, for firewater
16 makeup, not sure that the firewater system at this
17 plant is seismically qualified in a decent size
18 seismic event, it might look like a puddle on the
19 ground.

20 So a seismic failure within failure of RHR
21 leads me to absolutely no containment heat removal and
22 no core heat removal. It's not clear why the
23 conditional likelihood of a large early release isn't
24 fairly close to the core damage frequency in that
25 condition. And of course the example doesn't talk

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1 about large early release, it only talks about core
2 damage.

3 MR. LEHNER: Yes.

4 CHAIR STETKAR: So, so I'm kind of left
5 hanging on that metric, which is also considered in
6 the decision making process.

7 MS. DROUIN: Right.

8 CHAIR STETKAR: I mean the argument is
9 kind of made that says, well we sort of believe that
10 large early release frequency will scale with core
11 damage frequency the same way that it has done for
12 everything we looked at. But we didn't look at large
13 early release frequency for fires and we didn't look
14 at large early release frequency or core damage for
15 seismic.

16 MR. LEHNER: Right.

17 CHAIR STETKAR: So, so kind of try to be
18 sensitive to some of those things, because as I said,
19 the outside reader will read this as, oh okay, I can
20 use these types of arguments and the NRC will accept
21 them because these are the NRC's staff's examples.

22 MS. DROUIN: Right.

23 CHAIR STETKAR: There not EPRI's examples,
24 that's a different, that's a much different --

25 MS. DROUIN: Well we'll do another very

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1 good scrubbing of this.

2 CHAIR STETKAR: Much different dynamic.

3 MR. LEHNER: Yes.

4 CHAIR STETKAR: Okay.

5 MR. LEHNER: Yes, it's true the entire
6 fire LERF is dismissed because it's not available, so
7 it's treated --

8 CHAIR STETKAR: Well some of this, some of
9 the strange things about the fires, John, is that the,
10 there's actually a reasonable discussion on core
11 damage back in that appendix on the fires. And it
12 starts to explain, if you look at the conditional core
13 damage probability for fires, you know given a train
14 of RHR out versus transient, you know, the amalgam of
15 transients, the other transients, all the other
16 transients.

17 CHAIR STETKAR: It's clear the risk
18 profile is very different. Given that, it's not at
19 all clear to me why LERF would necessarily behave the
20 same way as inferred that LERF applies for the amalgam
21 of other transients and yet that whole issues is just
22 not addressed --

23 MR. LEHNER: To small.

24 CHAIR STETKAR: -- it's just basically
25 inferred that it's small enough to not make a

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1 difference without any other justifications. So
2 either, you know, as you work through the examples
3 either address it or make sure that it's really clear
4 that, you know, we didn't take up pages in this
5 document but somebody should --

6 MS. DROUIN: Yes.

7 CHAIR STETKAR: -- address these
8 particular issues somewhere. Without just, you know,
9 qualitative arguments to get rid of them. And I won't
10 take up anymore time. Anybody else have anything on
11 the appendix?

12 MS. DROUIN: Okay, then we just have on
13 final slid. Right now the NUREG is going through
14 internal staff review and that's a two month review.
15 So they've already, it went to them the same time it
16 came to the ACRS, so we've already done 30 days and we
17 have another 30 days for them to look at it and then
18 we will get their comments and as we address and
19 resolve theirs we will, you know, try and address and
20 resolve what we've heard from today's meeting.

21 So that when we release it for public
22 review hopefully, you know, we have, I mean we aren't
23 going to come back to you with our resolution before
24 we go public, but hopefully we understood you know,
25 all the points you've brought up. I mean I think we

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1 have, and I think the bulk of them are easily
2 addressed.

3 So that's going to happen in mid-August
4 for 60 days and then the review and comment closes in
5 mid October and we plan to have it published by the
6 end of November this calendar year.

7 CHAIR STETKAR: Now just, and I want to
8 make sure we leave enough time for EPRI, but --

9 MS. DROUIN: And that's, that's all I
10 have.

11 CHAIR STETKAR: Yes. Right at the moment
12 we have a Full Committee meeting scheduled on this
13 NUREG in October.

14 MR. LAI: September.

15 CHAIR STETKAR: Or September, some month
16 not July.

17 MR. LEHNER: Right.

18 MS. DROUIN: Yes the only thing, we just
19 have to coordinate is that, and I don't think it's a
20 problem, but I just want to double check.

21 (Off the record comments)

22 CHAIR STETKAR: This is our Full Committee
23 meeting --

24 MS. DROUIN: Right.

25 CHAIR STETKAR: -- so it will be --

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1 MS. DROUIN: So you're the first of
2 September.

3 MR. LEHNER: Before that probably.

4 CHAIR STETKAR: It will be way before, it's
5 probably the second calender week in September of this
6 year, I guess.

7 MS. DROUIN: Though we would be able to
8 come to the Full Committee and at least give you a
9 sense of what we did.

10 CHAIR STETKAR: At least to address some
11 of the comments that we've brought up here, you will
12 not have public comments folded in at that time.

13 MS. DROUIN: No, unless you want you us to
14 come back --

15 CHAIR STETKAR: But that's what, maybe we
16 should discuss it going forward to see, I don't want
17 to have multiple meetings on it. I'd rather see
18 something that looks like the final document
19 including, however you might respond to some of the
20 comments you've have from the subcommittee and public
21 comments.

22 MS. DROUIN: I'm coming back in either
23 November or December.

24 CHAIR STETKAR: Yes, well let's, you can
25 work offline with John, but that's --

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1 MS. DROUIN: Okay.

2 CHAIR STETKAR: That's how I think it
3 would make a lot more sense rather than, if you're
4 going to try to address some of our comments in an
5 interim phase and then fold in whatever other things
6 might come in from public comments. Having us look at
7 something that's between those two, as a Full
8 Committee, doesn't seem to awfully productive.

9 MS. DROUIN: Now --

10 CHAIR STETKAR: Especially if we decide to
11 write a letter, I mean the letter probably wouldn't be
12 fair and having two Full Committee meetings is not
13 worthwhile either.

14 MS. DROUIN: Well if you're going to
15 expect this 30 days in advance, then December would be
16 --

17 CHAIR STETKAR: Okay.

18 MS. DROUIN: -- the better timeframe.

19 CHAIR STETKAR: Well we'll work on the
20 timing offline, but it's starting to sound like the
21 September Full Committee meeting is not too
22 productive.

23 MS. DROUIN: Yes.

24 CHAIR STETKAR: And I tend to agree with
25 you, I don't think we need another Subcommittee

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1 meeting, but we should just make sure we schedule that
2 correctly. Anything else from any other --

3 MS. DROUIN: Well I just had one more
4 question, if you don't mind.

5 CHAIR STETKAR: Oh I'm sorry.

6 MS. DROUIN: You know it's been awhile
7 since I've been to the ACRS and I know the protocols
8 and everything changed, but I would love to be able to
9 send to John a list of, here were the key issues that
10 we heard, if we could get confirmation back just to
11 make sure we have good communication going on?

12 CHAIR STETKAR: Absolutely, please do
13 that.

14 MS. DROUIN: Okay.

15 CHAIR STETKAR: Anything that we can do to
16 help clarify things, we will absolutely do that and
17 just, as you said, pass it through John and if there's
18 nay question we will try to clarify.

19 MEMBER SHACK: They're only comments from
20 the Subcommittee so these are, so they're open?

21 CHAIR STETKAR: Yes, I mean this is the
22 Subcommittee, that's right, thanks Bill.

23 MS. DROUIN: Correct, but we've heard --

24 CHAIR STETKAR: This is not the ACRS.

25 MEMBER SHACK: This is not the ACRS, it's

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1 you know.

2 MS. DROUIN: This is what we heard from
3 you gentlemen here today.

4 MEMBER SHACK: That's correct.

5 CHAIR STETKAR: Five guys sitting around
6 a table.

7 MS. DROUIN: But the five best guys.

8 CHAIR STETKAR: Five guys, no five guys
9 sitting around a table. I have to be careful these
10 days that indeed it's only the five guys.

11 MS. DROUIN: So where's the hamburger and
12 fries?

13 CHAIR STETKAR: Yes there you go.
14 Anything else?

15 MS. DROUIN: No thank you very much, it
16 was a pleasure meeting --

17 CHAIR STETKAR: Any of the other members
18 have any questions? With that, thank you very, very
19 much.

20 MS. DROUIN: Thank you.

21 CHAIR STETKAR: I think it was good, good
22 presentation and --

23 MEMBER SHACK: Learned a lot.

24 CHAIR STETKAR: Good discussion and I
25 believe that we have some material from EPRI.

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1 MS. PRESLEY: My presentation is only two
2 slides long so.

3 CHAIR STETKAR: Your presentation is only
4 two slides, but I count six. So either someone
5 slipped --

6 MS. PRESLEY: We have two backup slides.

7 CHAIR STETKAR: Did someone --

8 MEMBER SHACK: Two black up slides. Okay
9 and a opening and closing right, so there is only two.

10 CHAIR STETKAR: Okay.

11 MS. PRESLEY: There you go.

12 MS. DROUIN: I have them loaded up for
13 you.

14 MS. PRESLEY: Okay.

15 CHAIR STETKAR: And we have a low budget
16 operation here, so you have to run everything
17 yourself.

18 MS. PRESLEY: Oh okay, thanks I got it.

19 MS. PRESLEY: So my name is Mary Presley,
20 I'm from EPRI. One of the newer project managers in
21 the Risk and Safety Management Group. Just handed
22 over, got this work handed over so hopefully I'll be
23 able to answer all of your questions, but there may be
24 a couple that I might have to defer.

25 So just the quick background is, we

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1 published 1016737, which was treatment of parameter
2 and model uncertainty for PRA in 2008 as a companion
3 report to the first, to the 1855. And that included
4 a section on parameter uncertainty and a section on
5 model uncertainty and then the bulk of the document
6 was an appendix which provided potential sources of
7 model uncertainty for internal events.

8 And the sections that had to do with
9 model, sorry, parameter uncertainty we included
10 additional guidance on state-of-knowledge correlation,
11 so some of the questions that had been asked about
12 what happens when you vary your important contributors
13 to --

14 MEMBER SHACK: Significant.

15 MS. PRESLEY: Significant contributors, or
16 potentially significant because of the state-of-
17 knowledge correlation, but they get truncated out.
18 There is some specific items in 1016737, not about
19 truncation, but about where to look for things that
20 are important state-of-knowledge correlations
21 importance.

22 So where you have a lots of ands, and it
23 gives some guidance on fractional contribution to risk
24 metrics based on error factor size and such. So that
25 gives the analyst some guidance of where to look and

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1 where they may have been truncated out.

2 CHAIR STETKAR: But the lots of ands still
3 depends on the generation of the cutsets so that
4 somebody could look at that, right?

5 MS. PRESLEY: Yes, or I mean.

6 CHAIR STETKAR: Which gets into the
7 truncation?

8 MS. PRESLEY: Yes.

9 CHAIR STETKAR: Okay.

10 MS. PRESLEY: But also knowledge of the
11 model, I mean.

12 CHAIR STETKAR: Yes, yes. But it does, I
13 thought I remembered that, it does address this notion
14 of look in places where you do have larger error
15 factors or uncertainties.

16 MS. PRESLEY: Yes.

17 CHAIR STETKAR: Okay.

18 MS. PRESLEY: And then in terms of, okay,
19 so in terms of -- I want to make sure I address all of
20 the questions that you guys have been asking. Model
21 uncertainty it also does speak a little bit to
22 sensitivity studies and how you should ensure you have
23 confidence in the sensitivity, how much confidence you
24 have in those sensitivity studies and the
25 justification that goes into that. There is a brief

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1 section on that and I think we're going to expand a
2 little bit on that in the next document.

3 So the original 1016737 will be retained
4 as it is and then the update that we're doing to go
5 with the revision of 1855 will be a new document.
6 Question on version control, this document is set,
7 that will be a fixed report number.

8 CHAIR STETKAR: Yes.

9 MS. PRESLEY: When they're updated it gets
10 a new report number, so when Mary cites something in
11 1855 with that number, she doesn't have to worry about
12 us changing stuff on her.

13 CHAIR STETKAR: Okay, good.

14 MS. PRESLEY: So the new report, we are
15 expecting initial draft by the end of July. We'd like
16 to put out our draft for comment, it will go to our
17 Technical Advisory Committee and it'll go to the NRC.
18 This is the closest thing we are doing to a pilot, is
19 getting review from our members. We can ask
20 specifically for them to look at its usefulness, if
21 there's suggestion for that we're open.

22 CHAIR STETKAR: I just, you know the,
23 certain, even the full ACRS can't speak about these
24 types of things. My own personal opinion knowing what
25 the industry has gone through with the fire stuff and

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1 NUREG/CR-6850, although in some sense this not as
2 convolved as all of those analyses, it still treads in
3 the area of unease and sort of philosophy of how to
4 actually implement this guidance that I suspect a lot
5 of people don't have any experience with at all.

6 And because of that, you know, despite
7 what comments you might get back from people who
8 haven't ever really thought about doing this, until
9 someone actually sits down and tries to go through the
10 process once and sort of follow the guidance and
11 struggle with what some of these terms might mean.

12 The first application that cites the fact
13 that it's being used, might have real difficulty. So
14 there might be, you know, a fairly strong benefit from
15 having somebody pilot this before, you know the part
16 of the problem is, to my knowledge, and I will learn
17 more about this in July. For example the, at least
18 the two pilot plants on NFPA 805 did not address
19 uncertainty, period.

20 And I know that to be a fact. I don't
21 know if the ones that are being submitted now are
22 addressing uncertainty, we'll learn a bit about that
23 in about a month. I have no idea whether the folks
24 were putting together the risk-informed technical
25 specifications for one of the new reactor designs have

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1 thought about addressing uncertainty. My suspicion is
2 they probably haven't.

3 Both of those are rather, certainly the
4 fires are pretty pervasive and visible throughout the
5 industry and certainly, from the perspective of the
6 one COL applicant, it's going to be a fairly important
7 licensing submittal for them.

8 MEMBER BLEY: Although we haven't reviewed
9 those completed analyses, from meetings it seems, at
10 least to me it seems pretty clear that some, at least
11 some of the unhappiness with conservatism has to do
12 with not actually doing uncertainty analysis but
13 assuming worst cases.

14 CHAIR STETKAR: In the fires I'm pretty --

15 MEMBER BLEY: In the fires, yes. That's
16 what I'm talking about, the fires yes.

17 MS. DROUIN: Can I jump in and say
18 something here?

19 CHAIR STETKAR: Yes.

20 MS. DROUIN: In support of the EPRI work,
21 one of the things that Mary hasn't talked about is
22 that they have a very systematic process that they've
23 described in their document for how they go about
24 identifying the sources of uncertainty.

25 And so that process which was used to

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1 identify for internal events and internal flood, in
2 the current document that process is still being used
3 on this new one, but in addition, and I know she's
4 going to talk to you a little, what this has in
5 addition to make the sources even more robust, for
6 lack of a better word, is that we did have this
7 workshop that we co-sponsored with EPRI where we
8 brought together quite a few experts in the field to
9 help us not only identify the sources but to
10 understand them and why they were sources et cetera.

11 So this new document that EPRI will be
12 coming out, has the benefit of this very successful
13 workshop that was held.

14 CHAIR STETKAR: Yes.

15 MS. PRESLEY: So as Mary mentioned we,
16 this new supplement will have the tables of generic
17 sources of uncertainty for the internal fires,
18 seismic, low-power shutdown at Level 2 based on this
19 workshop that we had. I have backup slides showing
20 participants and how the workshop was structured if
21 you're interested. And it was a joint effort with
22 NRC.

23 And then there will also be some
24 additional guidance in the update on preparing risk
25 informed applications. And a lot of that's going to

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1 be geared towards kind of a more practitioner level,
2 how to, there's the steps that are presented in 1855
3 and there's a lot of good detail in there. This is
4 going to be more focused that we're at the key
5 iteration points.

6 From a practical level how do you actually
7 exercise those steps and then on the other side how do
8 you, once you have the results, really what are some
9 practical ways of dissecting them so you understand
10 and build that picture of how your plant operates and
11 where your uncertainties really are. And then put
12 those into words when you're preparing a submittal.
13 So those are the guidance that's going to accompany
14 this new revision. Well that's it.

15 CHAIR STETKAR: Because of the time, I
16 think I understand what you did in the workshop and I
17 think that's really, really useful. And I think
18 Dennis mentioned this earlier, the only problem of
19 these types of workshops is that they're all the
20 experts in the field. They're the people who know,
21 and all of these folks have their own knowledge and
22 experience about what may be important and how they
23 address those things.

24 They're not the PRA practitioner out at
25 Plant X who suddenly has the charter to go and you are

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1 the lead to develop a risk-informed submittal for and
2 AOT extension in this framework.

3 MS. PRESLEY: Right.

4 CHAIR STETKAR: And that's, I think, a bit
5 of the problem that the fire stuff suffered under.
6 And I recognize several of the names on here from
7 example, the fire stuff. And everybody got together
8 and knew exactly what needed to be done and thought
9 that they expressed it in the clearest, best possible
10 way. And you hear people who are trying to use it
11 complain bitterly that it's not detailed enough or
12 it's too conservative or there's a misinterpretations
13 and there's finger pointing. And that's the problem.

14 MS. PRESLEY: There is some specific
15 guidance in the old, as Mary mentioned, it kind of
16 gives a four-step process for basically how you use
17 the tables and then tailor that to your plant. So
18 there is a little guidance, hand-holding, on how to go
19 from the, like thoughts, to something they can
20 actually use in a submittal. But a pilot would
21 probably, certainly gathering lessons learned once
22 it's been applied would be very beneficial.

23 MEMBER SHACK: Well this has been around
24 since 2008, have you had experience with people
25 actually using it?

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1 MS. PRESLEY: Yes. I know people have
2 used because I know I've gotten requests for Word
3 versions of the table. But I personally don't have
4 the history with the project to tell you in detail
5 what those are.

6 CHAIR STETKAR: Does the staff, is Steve
7 still here? Have you had any submittals that refer to
8 uncertainty analyses done according to this sort of
9 guidance?

10 MR. DINSMORE: No, sir.

11 CHAIR STETKAR: Thank you.

12 MS. DROUIN: Well it may not be reflected
13 explicitly in a submittal because 1855 is called out
14 as to be used in the standard. And it's called out to
15 be used in 1.200, like other specific documents. So
16 I would not be surprised that they would just say I
17 met 1.200. And they wouldn't come in and say well
18 I've met all of these other related documents.

19 CHAIR STETKAR: Okay. I was just curious.
20 Because in a lot of cases people will refer to EPRI
21 documents saying I followed this guidance.

22 MR. DINSMORE: Let me agree with Mary.
23 She gave a much better answer, but mine was shorter.

24 CHAIR STETKAR: Okay, thanks.

25 MEMBER SHACK: Well have you seen any

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1 evidence that reflects use of this document, even if
2 it's cited 1.200?

3 MR. DINSMORE: I personally don't know.
4 I would have to go look. We can do that though.

5 CHAIR STETKAR: I mean in some sense it
6 sounds like the scope of the document is certainly
7 being increased, if not just to address the other
8 hazards. And I'm sure there are a lot of other
9 changes in there that would --

10 MS. PRESLEY: And this is not an update in
11 that it changes anything in the original document, it
12 just adds additional guidance and additional tables.

13 CHAIR STETKAR: It hasn't changed the
14 basic philosophy of what was there. It just expands.
15 Okay.

16 MS. DROUIN: And for what it's worth we
17 have received, informally, you know, we're talking
18 with licensees that they are using it. And I think
19 how many public comments we get back, to me, is
20 indicative. Because if you aren't going to use it
21 people aren't going to waste their time giving
22 comments.

23 CHAIR STETKAR: Right.

24 MS. DROUIN: So when we first published it
25 and we had that public workshop we had a huge

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1 attendance at the workshop. And quite a few formal
2 comments submitted, which again, to me, why would you
3 spend the time to come to the workshop or provide the
4 comments if you weren't going to use it?

5 CHAIR STETKAR: Okay.

6 MEMBER SCHULTZ: So this is going to the
7 NRC for review as well as to the Technical Advisory
8 Committees?

9 MS. PRESLEY: Yes, and the MOU.

10 MEMBER SCHULTZ: And therefore, Mary,
11 there'll be some overlap with the internal review of
12 --

13 MS. DROUIN: Yes. And we're trying --

14 MEMBER SCHULTZ: -- the NUREG as well as
15 the EPRI guidance?

16 MS. DROUIN: Right. And we're trying to
17 closely coordinate our schedules.

18 MS. PRESLEY: Yes.

19 MS. DROUIN: So that we hit the publisher
20 at the same time.

21 MS. PRESLEY: And the intention is for us
22 to send our document out for review about the same
23 time that you all do yours, so we can let our
24 reviewers know to review them together.

25 CHAIR STETKAR: I guess one thing I

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1 struggled with a little bit, we did see the 2008
2 version of the EPRI report, I know we did because I
3 have notes on it. I don't recall whether we actually
4 discussed it in a Subcommittee meeting.

5 MEMBER BLEY: I think we did.

6 CHAIR STETKAR: I think we did. And I
7 guess the question to the other subcommittee members
8 is should we look at this one? You know we talked
9 earlier about going forward on 1855 and probably not
10 having another Subcommittee meeting on it, just bring
11 it to the Full Committee whenever the comments are
12 included. But there might be an incentive to have
13 another Subcommittee meeting to look, to a lesser
14 degree, on whatever interim changes you've thought ab
15 out for 1855. But more focus on the EPRI report.

16 MS. DROUIN: You know, I do know that in
17 the current published version of 1855, in the EPRI
18 document, that EPRI did come to the Subcommittee with
19 us and had a very detailed presentation on their
20 document. And they came in with their entire team,
21 didn't throw poor Mary out there by her lonesome. And
22 did a very detailed presentation. But that's up to
23 you guys whether you all want that or not, and whether
24 EPRI is willing to come.

25 CHAIR STETKAR: Well, I mean that's one

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1 thing. But I mean if there's essentially no interest
2 among the Subcommittee it's a moot point. If there is
3 it still might be a moot point.

4 MEMBER SCHULTZ: But are you thinking of
5 a meeting then that would be coordinated for perhaps
6 the September Subcommittee?

7 CHAIR STETKAR: It would probably be in
8 the September timeframe because that would, you know,
9 just the practicality of things, we're already full
10 for July and full for the August, I think,
11 Subcommittee meeting.

12 MS. PRESLEY: You'd like to see it before
13 they come back? After the public comments have been
14 addressed, because it --

15 CHAIR STETKAR: That's the big question.

16 MS. DROUIN: See the difficulty, John, is
17 you all's 30 day requirement of getting something 30
18 days in advance. I mean I can't speak for Mary, I
19 don't know if their schedule has that factored in. We
20 factor that into ours. But they may not have that in
21 there.

22 CHAIR STETKAR: I don't want to, you know,
23 belabor this because of the time today, but is there,
24 of the members that who are present --

25 MEMBER SHACK: Well, I think it would

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1 interesting you know, I think September is probably
2 too early.

3 MEMBER SHULTZ: Yes, I am looking more
4 carefully here, mid October --

5 CHAIR STETKAR: Dennis?

6 MEMBER BLEY: I think it's a good idea.

7 CHAIR STETKAR: Let's just pencil, we can
8 work out the logistics of the timing based on when the
9 reports, how you all are coordinating things going out
10 and things coming in, but let's try to do that then.
11 Let's pencil in another subcommittee meeting on, you
12 know, this general topic where we're in particular we
13 have an opportunity to focus more on the EPRI report
14 and what's in there and at the same time any changes,
15 wherever they are, in the mill for the NUREG.

16 MS. DROUIN: Okay.

17 MS. PRESLEY: For clarification you've
18 already been briefed on the older report, it's just
19 the new, the update that you want?

20 CHAIR STETKAR: Yes.

21 MS. PRESLEY: Okay.

22 CHAIR STETKAR: But in the same sense that
23 we're briefed on the older version, the previous
24 version of 1855 and obviously, you know, had some
25 exchange on this revision. There may be similar

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1 exchange on the newer --

2 MS. PRESLEY: All right.

3 CHAIR STETKAR: -- version of your report.
4 Any other questions or comments for Mary, if not thank
5 you very much. You absolutely held to your timeframe.
6 And we were good. Before we close out --

7 MR. LAI: The line is open.

8 CHAIR STETKAR: I am not seeing a lot of
9 public in the room but I have to ask, is anybody, any
10 members of the public, anybody want to make any other
11 comments?

12 If not I think the bridge line is open, if
13 there is someone out there could you just make a noise
14 or at least acknowledge your existence so we can
15 confirm that the line is open, say something?

16 Okay that either means it's not open or
17 there's no one there. I'm assuming it's open.

18 MEMBER BLEY: Did we go around?

19 CHAIR STETKAR: We haven't yet, I just
20 wanted to ask for comments first. Okay, hearing no
21 public comments then, as we usually do, let's go
22 around the table and get some final comments,
23 questions, observations by the subcommittee members
24 and we'll go with Steve first.

25 MEMBER SHULTZ: I have no additional

1 comments, except to again thank the staff and EPRI for
2 the presentations. I thought they were very thorough
3 and presented the information with the status of the
4 project very well. I do feel that it would be
5 worthwhile, given the importance of this work and what
6 we expect it to be in terms of its usage, to revisit
7 it and follow this carefully until its finally up.

8 CHAIR STETKAR: Thank you, Dennis?

9 MEMBER BLEY: Yes I would say ditto to the
10 presentations, the discussion and all the work that
11 went on between the last time we saw everyone and now.
12 We've raised a number of issues that I guess still
13 concern me. There's just one I want to revisit in
14 closing remarks, and that has to do with the decision
15 that if one uses a consensus model you don't have to
16 deal with model uncertainty.

17 I guess I don't really understand that, I
18 do know that the standard says the same thing. It's
19 kind of, I guess we're really saying 1855 does not
20 require addressing the model uncertainty. What would
21 seem more reasonable to me, with a consensus approach,
22 would be that if that approach includes a full
23 treatment of uncertainty then the use of that
24 uncertainty from the consensus model would be
25 perfectly adequate.

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1 But if it doesn't address its uncertainty,
2 I don't see how we dodge looking at the model
3 uncertainty. It just doesn't hang together. That's
4 all.

5 CHAIR STETKAR: Thank you, Bill?

6 MEMBER SHACK: Well I just wanted to say,
7 I think you know, comparing the two versions, the Rev
8 0 and the Rev 1, having never done a PRA I really
9 can't tell, but it certainly seems to me we now have
10 a process that really wasn't in the original. The
11 original one as you said is more discussion, but this
12 really does seem like a process and I'll be very
13 interested to see some products that come out, you
14 know, maybe we will see risk-informed presentations
15 that reflect this process.

16 I kind of agree with Dennis that you know,
17 that there is that hanging problem with the consensus
18 model. I did sort of somehow get an implicit kind of
19 or an assumption that somehow the parameter of
20 uncertainty with a consensus model kind of addressed
21 the uncertainty associated with the model, but that
22 really is kind of iffy to, but you know.

23 But again, it's hard to see how you can
24 really not address the model uncertainty even if it's
25 a consensus model, its impact you know, and whether

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1 it's done with, somehow demonstrate that the parameter
2 uncertainty really does cover it or you've done enough
3 insensitivity studies that somehow it really does seem
4 that it has addressed.

5 CHAIR STETKAR: What was the, we saw one
6 recently where they looked at model and uncertainty,
7 and I thought did a pretty decent job on it. Not a
8 risk-informed.

9 MEMBER SHACK: You mean SOARCA?

10 CHAIR STETKAR: No not SOARCA. It was, I
11 think it was the XLPR. Was that the pipe-rupture?

12 MEMBER SHACK: The pipe-rupture people.

13 MEMBER BLEY: Oh yes.

14 CHAIR STETKAR: They had a kind of a neat
15 way of looking at that if I recall. I don't remember
16 any of the details, but I mean that, it struck me as
17 --

18 MEMBER SHACK: Well they did a very
19 formalistic kind of uncertainty analysis. I think
20 that it would be tough to duplicate here, because
21 they're dealing with a very narrow topic.

22 CHAIR STETKAR: That's true.

23 MEMBER SHACK: But it just seems to me
24 that, that does seem to be a problem with, as I say,
25 it seems to me as a process it goes a long way towards

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1 addressing issues at the, that ACRS has complained
2 about for years as far as uncertainty associated.

3 And Steve might actually even being to
4 expect to find things other than the mean value. If
5 he you know, if people really did follow this and I
6 think that's one other comment I would make, is that
7 if NRR doesn't look at the uncertainty analysis it's
8 not going to get used and so I think there has to be
9 an expectation here that the NRC now expects these
10 uncertainty analysis to accompany risk-informed
11 applications.

12 MS. DROUIN: See and I believe that's a
13 true fundamental change from NRC's position and I'm
14 not disagreeing with you, I'm just saying if that
15 expectation now changes where it's not only
16 considering the mean value, but also you know, what is
17 the size of the uncertainty.

18 MEMBER SHACK: Yes, I mean agree with the
19 1.174 that the mean value is the, you know, if you've
20 satisfied the criteria and you satisfied the criteria
21 from the mean value, but I think as far as the over
22 all decision in a 1.174 process, knowing the
23 uncertainty is important, goes along with mean value.

24 MS. DROUIN: Yes, all I'm saying is that,
25 that's not their position right now and I think if you

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1 wanted to move over to that and I'm not disagreeing
2 that it should go there, but I think you're making a
3 fundamental change in a policy somewhat that would
4 probably have to go all the way to the Commission.
5 That's just my personal view there.

6 MEMBER SHACK: Well then if we get around
7 to writing the letter on this, that might well be one
8 of the issues.

9 CHAIR STETKAR: That's not new ground.

10 MS. DROUIN: Yes, I am just saying I think
11 if I went to NRR and NRO right now and said you know,
12 we want to now do I think I would get whoa, whoa.

13 CHAIR STETKAR: Against policy, yes.

14 MS. DROUIN: No, no this is how we do it.

15 MEMBER SHACK: Okay, I mean I see it as a
16 policy change, because it seemed to me that the
17 decision process in 1.174 would include this.

18 MS. DROUIN: I'm just saying that has not
19 been the interpretation.

20 CHAIR STETKAR: That certainly does not
21 preclude it.

22 MEMBER SHULTZ: Doesn't preclude it.

23 MS. DROUIN: Right.

24 CHAIR STETKAR: And at least qualitatively
25 seems to endorse them.

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1 MR. LACHANCE: This is Jeff LaChance, just
2 want you know to point out one thing with regard to
3 that when Reg Guide 1.174, the guidance criteria was
4 established, they did you know, they wrote some SECYS
5 on this with regard to, you know, should they use the
6 mean, the 95th percentile or use the uncertainty, and
7 so I mean that's all ground that was considered, you
8 know, years and years ago. Doesn't mean it can't be
9 revisited but I just want to point out to you, that
10 there was consideration to this.

11 CHAIR STETKAR: Well certainly, I think
12 you know from our perspective we've sort of raised
13 some concerns here at the Subcommittee level, it's not
14 the ACRS it's the Subcommittee. I think we'd be
15 interested to see, you know, if and how those concerns
16 are addressed in the final version of 1855.

17 MS. DROUIN: Well trust me I'm going to
18 re-raise it, from a personal perspective, I don't know
19 how you cannot consider the size of the uncertainty
20 and say you've adequately treated uncertainty, but you
21 know, that's not my call.

22 CHAIR STETKAR: That's right. But I was
23 going to say, in terms of process I think that yes,
24 any decision on the Committee's part certainly, if
25 we're going to write a letter on this issue, we'd

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1 certainly look at the old SECYs and what ground was
2 plowed.

3 (Simultaneous speaking.)

4 MEMBER BLEY: In the beginning before we
5 have a Full Committee meeting, maybe John could track
6 that down for us and get --

7 MS. DROUIN: Because in this revision we
8 had it in there, We actually had as part of the --

9 MEMBER BLEY: Oh you did?

10 MS. DROUIN: Yes we did, and we took it
11 out.

12 MEMBER BLEY: Ah.

13 MS. DROUIN: Because it was not the way we
14 do business. That was, this is how it's been
15 interpreted.

16 CHAIR STETKAR: Okay, good. Thank you.

17 MEMBER BLEY: Thanks that helps me a
18 little.

19 CHAIR STETKAR: Anything more Bill?

20 MEMBER SHACK: No.

21 CHAIR STETKAR: And I don't have anything.
22 I echo Dennis's and Bill's concerns about the model
23 uncertainty and particular the overall use of
24 uncertainty in the decision making process. Certainly
25 and I have made a lot of other you know, specific

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1 comments. I do by the way, all of the negativity and
2 my comments, that's just the kind of person I am.

3 The NUREG is an awful lot better than it
4 was three years ago, an awful lot better. And I think
5 that it's, I think we're really close to having a
6 process and kind of an understanding that, as you said
7 Mary, can kind of push the whole agency in the
8 direction that I think both needs to be pushed, in
9 some cases pushed, and in other cases kind of bring
10 together a little bit of diverse opinions about how
11 things should be addressed. So I do think this was an
12 important effort, it's just not a run of the mill
13 NUREG.

14 And I think you folks have done a really
15 good job you know, getting to where you are on it.

16 MS. DROUIN: Thank you. I mean I am such
17 a believer in risk-informed regulation, but I think
18 that you cannot go forward, truly forward, and fully
19 embrace it without having a good understanding of your
20 uncertainties.

21 CHAIR STETKAR: Amen. Anything else from
22 anyone, if not thank you all we are adjourned.

23 (Whereupon, the meeting in the above-
24 mentioned matter was concluded at 5:27 p.m.)

25



Revision 1 to NUREG-1855, “Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decisionmaking”

Presented to ACRS Subcommittee on PRA

June 19, 2012

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- Background
- Objective
- Scope
- NUREG Structure
- Overall Approach
- Detailed Guidance
- Appendix
- Steps Forward

- ❑ In letters dated April 21, 2003, and May 16, 2003, ACRS recommended guidance be developed on how to perform sensitivity and uncertainty analyses.
 - More specifically, guidance on both how to treat the uncertainties but also guidance on the acceptable characterization of other methods, such as bounding analyses, to ensure that reasonable approaches are used
- ❑ In a letter dated February 23, 2009, ACRS supported publication of the NUREG but did not believe Appendix A (an example test case) should be published until it was revised.
- ❑ NUREG-1855 was first issued for draft in November 2007 and then for use in March 2009; Appendix A has never been published.
- ❑ The staff met with the subcommittee on March 27, 2009, the Committee supported the proposed staff changes.
 - Staff agreed to meet with ACRS to go over final revisions to Appendix A; however, ACRS deferred the meeting

BACKGROUND (CONT'D)

- A major public workshop was held (May 5 and 6, 2009) and a test case using the guidance in the NUREG to assess the effectiveness of this guidance was provided (Appendix A).
 - Insights from the public, the test case, and risk-informed activities identified numerous areas for improvement to the guidance and scope of this NUREG.
 - Most significant insight was the difficulty to discern guidance for the licensee versus guidance for the staff.
- Major change involved a restructuring of the document and development of explicit process in describing the guidance for the treatment of the uncertainties.
- Scope was expanded to include sources of uncertainties associated with low power shutdown, internal fire, seismic, and Level 2 PRA
 - This expanded scope primarily affected the EPRI report.

- ❑ Objectives – provide guidance with regard to:
 - identifying and characterizing the uncertainties associated with PRA
 - performing uncertainty analyses to understand the impact of the uncertainties on the results of the PRA
 - factoring the results of the uncertainty analyses into the decisionmaking

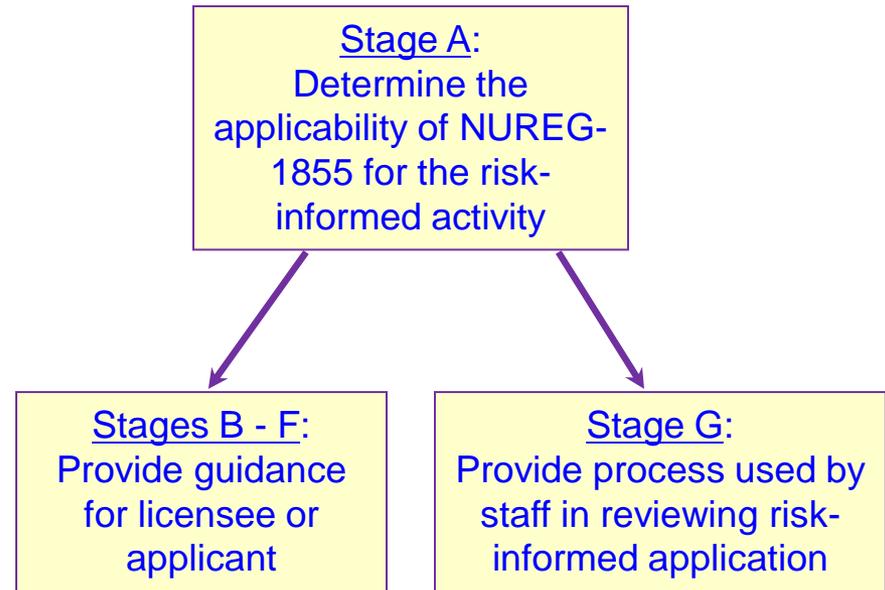
- ❑ NRC and EPRI, under an MOU, have developed companion guidance documents which are meant to complement each other and are intended to be used as such when assessing the treatment of uncertainties in PRAs used in risk-informed decisionmaking.

- Scope (NUREG) – guidance on the uncertainty identification and characterization process and on the process of factoring the results into the decisionmaking is generic and independent of the specific source of uncertainty.
 - Consequently, the guidance is applicable for sources of uncertainty in PRAs that address at-power and low power and shutdown operating conditions, and both internal and external hazards.

- Scope (EPRI report) –
 - SOKC correlation
 - List of generic sources of uncertainties for Level 1 and Level 2 for internal hazards and seismic and all plant operating modes

NUREG RESTRUCTURE

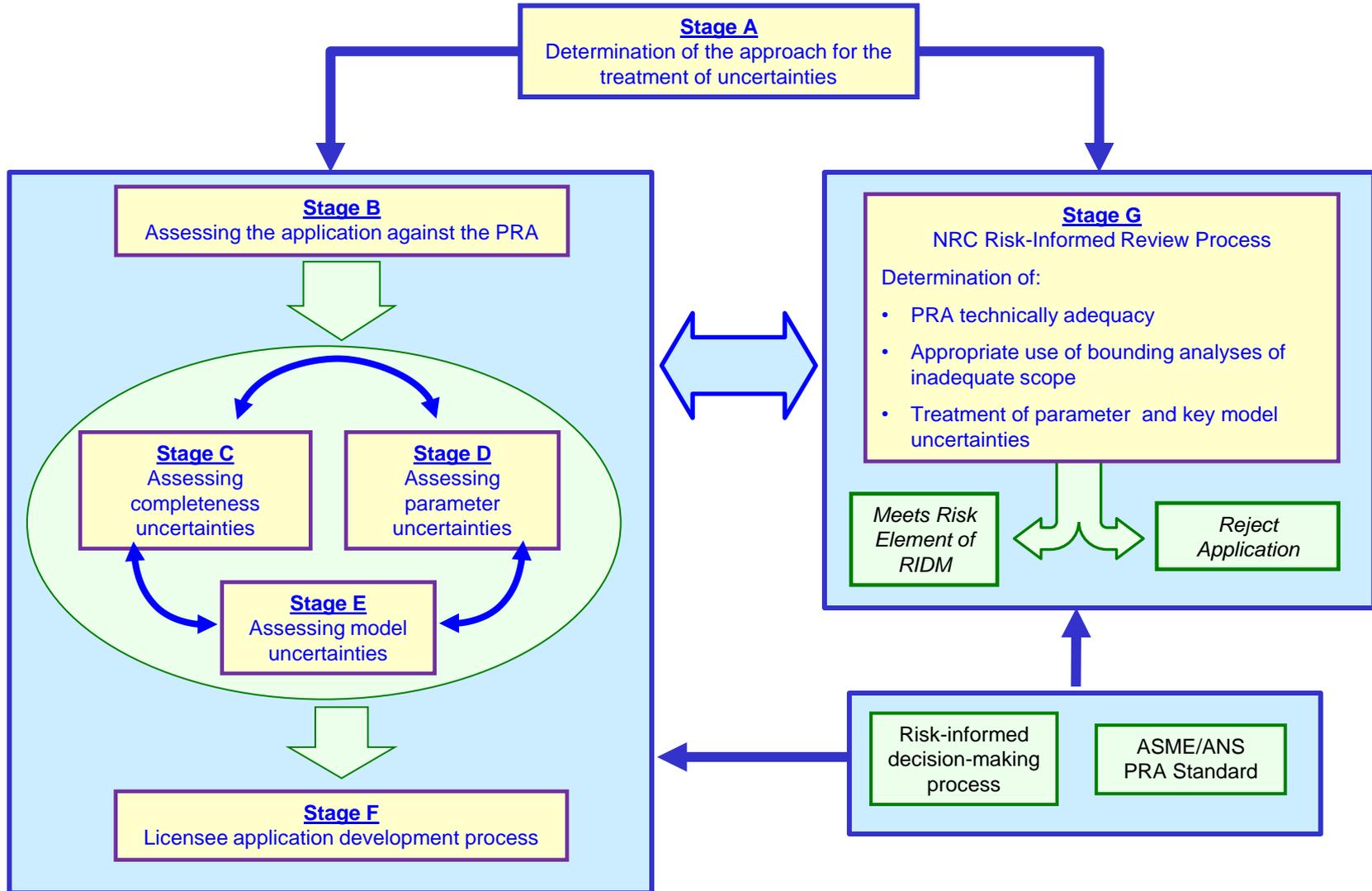
- ❑ Guidance organized into three parts around seven stages:
 - Stage A: Determine if application subject to NUREG-1855
 - Stages B-F: Guidance for licensee or applicant
 - Stage G: Process used by staff



NUREG RESTRUCTURE

- ❑ Part 1 – Stage A: Determine if application is subject to NUREG-1855
 - This guidance generally involves understanding the type of application and the type of risk analysis and results needed to support the application.
- ❑ Part 2 – Stages B-F: Guidance for licensee or applicant
 - Stage B: Understanding risk-informed application and determining the scope of the PRA needed to support the application
 - Stage C: Evaluating the completeness of the PRA model and determining if bounding analyses are acceptable for the missing scope
 - Stage D: Evaluating the parameter uncertainties; i.e., determining if the risk results meet the applicable acceptance guidelines
 - Stage E: Evaluating model uncertainties to determine their impact on the applicable acceptance guidelines
 - Stage F: Developing strategies to address key uncertainties in the application
- ❑ Part 3 – Stage G: Process used by staff
 - This process generally involves confirming that the licensee has provided adequate justification regarding the risk results as compared to the acceptance guidelines

NUREG RESTRUCTURE



OVERALL APPROACH

- Both the licensee and the staff need to have a clear understanding of
 - the application and the risk contributors that can affect the decision
 - the uncertainties, in the context of the decision under consideration
 - the impact of the uncertainties on the risk results and acceptance guidelines being used to support the decision under consideration
 - the requirements in the ASME/ANS PRA standards regarding uncertainties, as endorsed by the NRC

TYPES OF UNCERTAINTIES

- ❑ Completeness uncertainty relates to risk contributors that are not accounted for in the PRA model.
 - This type of uncertainty may further be categorized as either being known, but not included in the PRA model, or unknown. Both known and unknown types of uncertainty are important.
- ❑ Parameter uncertainty relates to the uncertainty in the computation of the input parameter values used to quantify the frequencies and probabilities of the events in the PRA logic model.
 - These uncertainties can be characterized by probability distributions that relate to the analysts' degree of belief in the values of these parameters (which could be derived from simple statistical models or from more sophisticated models).
- ❑ Model uncertainty relates to the uncertainty associated with some aspect of a PRA model that can be represented by any one of several different modeling approaches
 - Uncertainty is introduced into the PRA results since there is no consensus about which model most appropriately represents the particular aspect of the plant being modeled.

PRA STANDARD REQUIREMENTS

- For parameter uncertainties, the Standard, as endorsed by the NRC, requires:
 - Depending on the significance of the basic event, mean values or point estimates are acceptable with characterizing the uncertainty either qualitatively or with a probabilistic representation
 - Depending on the significance of the sequences and the state-of-knowledge-correlation, mean values or point estimates of the risk metrics are acceptable with an estimate of the uncertainty interval or with propagating the uncertainty distribution

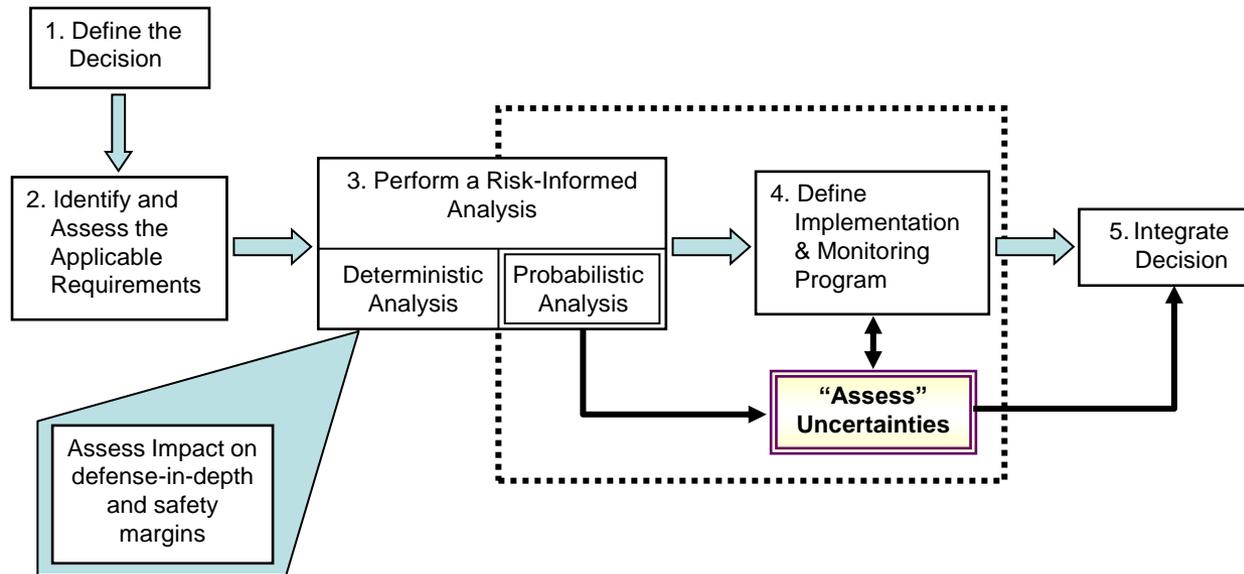
PRA STANDARD REQUIREMENTS

- For model uncertainties, the Standard, as endorsed by the NRC, requires:
 - Identifying sources of model uncertainty and characterizing the effect of those sources on the PRA (e.g., introduction of a new basic event, changes to basic event probabilities, change in success criterion, or introduction of a new initiating event)
 - A source of model uncertainty exists when (1) a credible assumption (decision or judgment) is made regarding the choice of the data, approach, or model used to address an issue because there is no consensus and (2) the choice of data, approach or model is known to have an impact on the PRA model. An impact on the PRA model could include the introduction of a new basic event, changes to basic event probabilities, change in success criteria, or introduction of a new initiating event. A credible assumption is one which has a sound technical basis such that the basis would receive broad acceptance within the relevant technical community. The relevant technical community includes those individuals with explicit knowledge and experience for the given issue.

RISK-INFORMED DECISIONMAKING PROCESS

- ❑ The NRC defined a set of key principles to be followed for risk-informed decisions:
 - Principle 1: Current Regulations Met
 - Principle 2: Consistency with Defense-in-Depth Philosophy
 - Principle 3: Maintenance of Safety Margins
 - Principle 4: Acceptable Risk Impact
 - Principle 5: Monitor Performance
- ❑ The principles of risk-informed decisionmaking are expected to be observed; however, they do not describe the process that is used in risk-informed decisionmaking.

RISK-INFORMED DECISIONMAKING PROCESS (CONT'D)



- ❑ The above elements constitute the steps of an integrated risk-informed decisionmaking process.
- ❑ The licensee identifies the uncertainties and determines their impact on the PRA results and, ultimately, on the acceptance guidelines.
- ❑ The NRC staff is determines whether the process followed by the licensee is adequate.

STAGE A: APPROACH FOR TREATING RISK ASSESSMENT UNCERTAINTIES

- ❑ Objective: guidance to both the licensee and the staff on determining whether the approach in NUREG-1855 for treating PRA uncertainties should be used for the risk-informed activity (i.e., the decision) under consideration.
- ❑ The approach used to address uncertainties can vary and is dependent on the nature of the risk-informed activity under consideration.
- ❑ The guidance involves two steps:
 - Step A-1: The type of risk results used in the application – Are the risk results PRA or non-PRA in nature?
 - Step A-2: Application of PRA results – If the results are from a PRA, how are the results being used to support the decision?
- ❑ Outcome: a determination of whether known regulatory risk-informed activities should be subject to the process in NUREG-1855 has been performed

STAGE A (CONT'D)

- ❑ **Step A-1**: The purpose of this step is to determine whether the development of a PRA model is needed.
- ❑ This NUREG provides an approach (guidance) for the treatment of uncertainties relative to quantitative acceptance guidelines
 - for many decisions, the primary measure for determining acceptability of the decision is whether the quantitative acceptance guidelines are challenged by the risk results
- ❑ If a given risk-informed activity is determined to be a licensee-initiated regulatory activity, but does not utilize the results from a PRA, it is not subject to the approach for the treatment of uncertainties provided in this NUREG.

STAGE A (CONT'D)

- ❑ **Step A-2**: the purpose of this step is to determine how the PRA results are used to support the decision under consideration. Addressing the uncertainties in the PRA is dependent on how the results are being used.
- ❑ Examples of different uses include:
 - The risk metrics from the PRA are continuously being evaluated such that at any time, the risk associated with the current configuration is known (i.e., a risk monitor).
 - The decision under consideration is based on reviewing the PRA risk results against specified regulatory acceptance guidelines.
 - The risk significance of a decision is being evaluated at the time of occurrence of an event.

STAGE A (CONT'D)

Examples of applications subject and not subject to NUREG-1855:

- ❑ Technical Specification Initiative 5b, Risk-Informed Surveillance Frequencies
 - Evaluates Δ risk
 - Utilizes a PRA
 - Risk is not continuously evaluated
 - Risk is evaluated to support initiative
 - Risk not evaluated as a result of an event
 - Subject to NUREG-1855
- ❑ Maintenance Rule, 10CFR 50.65 (a)(2)
 - Utilizes a risk monitor
 - Utilizes a PRA
 - Risk is continuously evaluated
 - Risk not evaluated to support initiative
 - Risk not evaluated as a result of an event
 - Not subject to NUREG-1855

STAGE B: ASSESSING PRA SCOPE AND LEVEL OF DETAIL

- ❑ Objective: provides guidance to the licensee on determining the scope and level of detail of a PRA needed to support a risk-informed application.
- ❑ The required PRA scope and level of detail can vary for different risk-informed activities. It is important that the PRA address all important contributors to risk that can be affected by a proposed risk-informed activity and their associated uncertainties.
- ❑ The guidance involves 3 steps:
 - Step B-1: Understanding the risk-informed application and decision.
 - Step B-2: Identify the PRA scope and level of detail needed for the risk-informed application.
 - Step B-3: Address the missing PRA scope or level of detail needed for the risk-informed application.
- ❑ This is a new section that consolidates guidance from Sections 2.2, 3.1, 3.2 and 6.2 in previous version of NUREG-1855.

STAGE B (CONT'D)

- ❑ **Step B-1**: The purpose of this step is to determine the aspects of the plant design and operation that will be affected by a proposed risk-informed application.
- ❑ A key aspect in this process is identifying what results are needed to support the application.
 - The results needed are generally formulated in terms of acceptance guidelines.
 - Acceptance guidelines can vary from decision to decision and include metrics such as CDF, LERF, and importance measures.
 - Acceptance guidelines also should include guidance on how the metric is to be calculated, in particular with regard to addressing uncertainty.
- ❑ All impacts of a proposed application including the effect on the prevention and mitigation of transients or accidents are identified. This includes effects on both safety and non-safety related features.

STAGE B (CONT'D)

- ❑ **Step B-2**: The purpose of this step is to determine the PRA scope and level of detail needed to support a risk-informed application.
- ❑ PRA scope is defined in terms of the following:
 - The metrics used to evaluate risk.
 - The plant operating states (POSS) for which the risk is to be evaluated.
 - The types of hazard groups and initiating events that can occur
- ❑ Level of detail of a PRA is defined in terms of:
 - The degree to which the potential spectrum of scenarios is discretized.
 - The degree to which the actual plant is modeled.

STAGE B (CONT'D)

- ❑ The required PRA scope and level of detail is generally determined by considering the cause-and-effect relationship between the application and its impact on plant risk through changes to SSCs and plant operation.
- ❑ A proposed application can impact multiple SSCs in various ways and may require changes to one or more PRA technical elements.
- ❑ Required modifications could manifest as changes to parameters in the PRA model; introduction of new events; or changes in the logic structure. For example:
 - Introduces a new initiating event or component failure mode
 - Introduces a new accident sequence
 - Changes system success criteria or dependencies
 - Eliminates, adds, or modifies human actions
 - Changes SSCs required to mitigate external hazards
 - Changes the potential for containment bypass

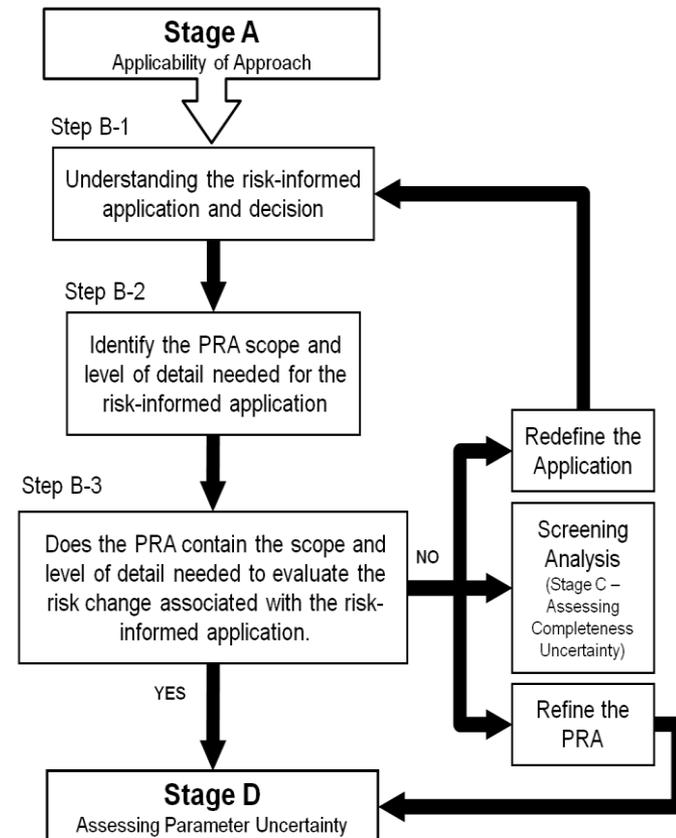
STAGE B (CONT'D)

- ❑ **Step B-3:** The purpose of this step is to determine if the PRA contains the scope or level of detail needed to evaluate the risk change associated with a risk-informed application.
- ❑ Stage B also addresses aggregation of results from different PRA models.
- ❑ Because hazard groups and POSs are independent, addition of their risk contributions is mathematically correct.
- ❑ However, several issues should be considered when combining the results from different hazard groups.
 - Level of detail and approximations may differ for different hazard groups with some being more conservatively evaluated.
 - The level of detail, scope, and resulting conservative biases in a PRA introduces uncertainties in the PRA results.
 - Need to consider the influence of known conservatism when comparing the results against the acceptance guidelines, particularly if they mask the real risk contributors (i.e., distort the risk profile) or result in exceeding the guidelines.

STAGE B (CONT'D)

□ In assessing the necessary scope and level of detail of the PRA for the given application, the licensee will arrive at one of three conclusions – *The PRA scope and level of detail*

1. *is adequate to support the application*
 - Licensee moves to Stage D of the process
2. *is not adequate and the licensee decides to refine the PRA*
 - Licensee moves to Stage D of the process
3. *is not adequate and the licensee decides to redefine the application*
 - Licensee returns to the beginning of Stage B of the process
4. *is not adequate and the licensee decides to determine the significance of the missing scope and level of detail and if it's contribution can be bound*
 - Licensee moves to Stage C of the process



STAGE C: ASSESSING COMPLETENESS UNCERTAINTY

- ❑ Objective: provides guidance to the licensee on how to address the completeness of the PRA results that are used in support of risk-informed applications.
- ❑ Addresses the scope and level-of-detail items that are not modeled in the PRA by determining whether missing items (e.g., a hazard group, an initiating event, a component failure mode, etc.) are significant to the decision under consideration.
- ❑ The guidance involves 2 steps:
 - Step C-1: Perform screening analyses to determine the significance of the missing PRA scope or level of detail to the risk-informed decision.
 - Step C-2: Determine if the PRA model needs to be updated or if the application needs to be modified to address the missing PRA scope or level of detail significant to the decision.
- ❑ The risk from each significant hazard group should be addressed using a PRA model that is developed in accordance with an NRC-endorsed consensus standard for that hazard group.

STAGE C (CONT'D)

- Changes on completeness uncertainty guidance:
 - Guidance on completeness uncertainty is now considered before parameter and model uncertainty in the new version.
 - The process in Step 1 of the old version, “Determining the Required Scope and Level of Detail Required to support Risk-Informed Decision” has been moved to Stage B in the new version.
 - A table has been added identifying the Supporting Requirements in the PRA Standard that address screening requirements.
 - Content has been reorganized in a more concise manor.

STAGE C (CONT'D)

- ❑ **Step C-1**: The purpose of this step is to provide guidance for determining whether the missing scope or level of detail of the PRA (as determined in Stage B) is risk significant to the decision under consideration.
- ❑ The process of determining the risk significance of a missing scope or level of detail PRA item can include performing either a qualitative or quantitative screening analysis.
- ❑ The screening and significance assessment process in Stage C consists of the following steps:
 - Substep C-1.1: Perform qualitative screening
 - Substep C-1.2: Perform quantitative screening
 - Substep C-1.3: Determine significance of unscreened scope items

STAGE C (CONT'D)

- ❑ **Substep C-1.1**: Utilize qualitative screening criteria to eliminate potential hazards or risk contributors from the PRA.
- ❑ The NRC staff is developing a position on acceptable qualitative and quantitative screening criteria which will be published in an Interim Staff Guidance document.
- ❑ Examples of qualitative screening criteria to eliminate hazards or other risk contributors include the following:
 - The contributor or hazard does not result in a plant trip.
 - The plant response to the hazard is not affected by the proposed application.
 - The contributor or hazard can be bounded by another event.
- ❑ Additional criteria can be defined for specific applications but the bases would have to be documented.

STAGE C (CONT'D)

- ❑ **Substep C-1.2:** Utilize quantitative screening criteria to eliminate potential hazards or risk contributors from the PRA.
- ❑ The principal utility of a conservative quantitative risk analysis is to demonstrate that the risk contributions from non-modeled scope items as well as any change to the risk contribution that results from a change in the plant are small and, thus, not significant to the decision.
- ❑ If a PRA scope item is not screened based on a quantitative analysis, the results of that analysis can be used in the application to provide a conservative risk estimate if the item is not significant to the decision, as determined in Step C-2.
 - Conservative risk assessments exaggerate the importance of initiating events, component failure modes, and accident sequences
 - The usefulness of a conservative analysis is somewhat limited, particularly in applications relying on relative importance measures

STAGE C (CONT'D)

- Different levels of quantitative analysis are used for screening or evaluating the importance of missing PRA scope and level of detail:
 - Bounding conservative analysis – includes the worst credible scenario that can occur. Can be bounding in terms of frequency, consequences, or risk.
 - For example, assuming that all fires or floods in a specific area (maximum frequency) fails all equipment in that location (maximum consequences) combined with taking no credit for mitigation systems (e.g., fire suppression or floor drains).
 - Conservative, but not bounding analysis - produces a quantified estimate of a risk metric that is significantly greater than the risk metric estimate that would be obtained by using a best-estimate evaluation.
 - For example, assuming all seismic events result in loss of offsite power (LOSP) transients or LOSP events combined with a small loss-of-coolant accident (LOCA), the latter assumption resulting in a more conservative model of seismic events, especially those of low magnitude
 - Realistic, but limited quantitative analysis – utilizes an iterative process of screening to try and eliminate a missing scope item.
 - For example, modeling an accident sequence where not all mitigating systems are credited.

STAGE C (CONT'D)

- ❑ **Substep C-1.3**: Determine the significance of non-modeled scope or level of detail items by comparing conservative risk estimate against risk acceptance guidelines.
- ❑ The degree to which the conservative risk estimate can be used to support the claim that the missing scope or level of detail in the PRA does not impact the decision depends on the proximity of the risk results to the guidelines.
- ❑ Conservative risk assessments exaggerate the importance of initiating events, component failure modes, and accident sequences
- ❑ Care should be taken to make sure that any assumptions that are meant to screen out or bound a hazard group are not invalid for a specific application.
 - For example, the assumption that tornados can be screened based on the assumption of the existence of tornado missile barriers, may be invalid for situations where a barrier is temporarily moved for a particular plant evolution

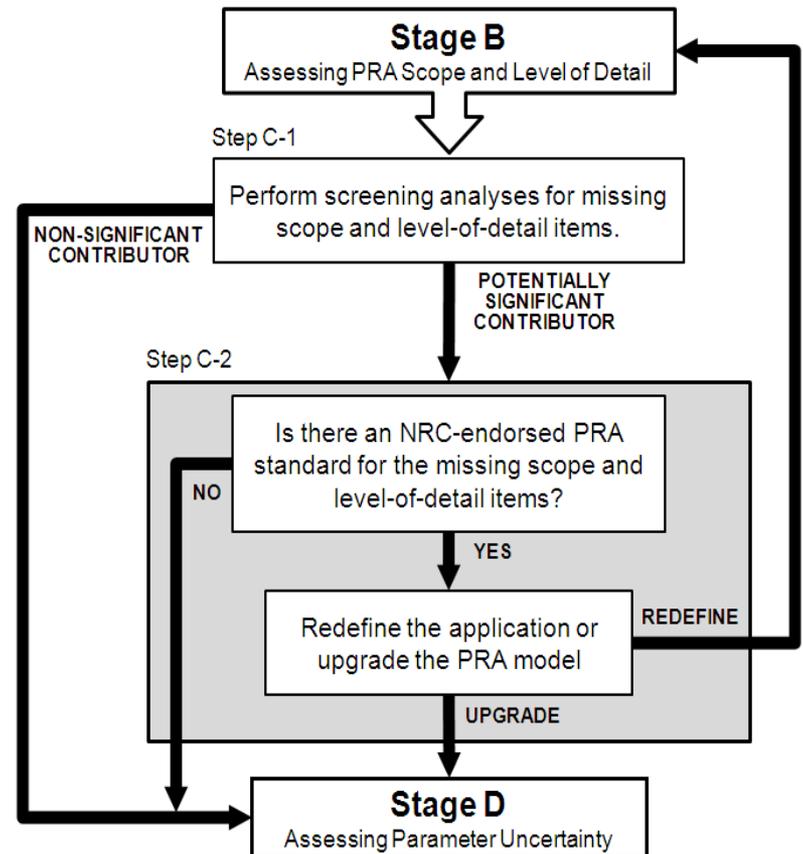
STAGE C (CONT'D)

- ❑ **Step C-2**: The purpose of this step is to provide guidance for determining the possible ways to treat non-modeled scope or level-of-detail items that are significant to the decision.
- ❑ A significant risk contributor is one whose inclusion in the application PRA model can impact the decision.
- ❑ The risk from each significant non-modeled scope or level-of-detail item should be addressed using a PRA model that is developed in accordance with a consensus standard for that item that has been endorsed by the NRC staff.
- ❑ However, if there is no PRA standard that addresses the missing scope or level-of-detail item in question, the licensee can submit the results of a quantitative screening analysis as part of the input into the decisionmaking process.

STAGE C (CONT'D)

□ In assessing the missing scope and level of detail of the PRA for the given application, the licensee will arrive at one of three conclusions – *The missing scope and level of detail*

1. *is not significant to the application*
 - Licensee moves to Stage D of the process
2. *is significant to the application, and there is no standard endorsed by the NRC*
 - Licensee moves to Stage D of the process
3. *is significant to the application, and there is a standard endorsed by the NRC*
 - Licensee redefines the application and returns to the beginning of Stage B of the process
 - Licensee upgrades the PRA and moves to Stage D of the process



STAGE D: ASSESSING PARAMETER UNCERTAINTY

- ❑ Objective: guidance to the applicant for calculating the PRA results and those uncertainties in the results that arise from the propagation of the uncertainty in the input parameter values.
- ❑ In this step the determination is made whether the risk results challenge the acceptance guidelines.
- ❑ The guidance involves three steps:
 - Step D-1: Acceptable ways to characterize the uncertainty in the parameters used in the various PRA inputs.
 - Step D-2: Acceptable ways to quantify the risk metrics, accounting for the parameter uncertainty and the state-of-knowledge-correlation (SOKC).
 - Step D-3: How to compare the results with the acceptance guidelines.

STAGE D (CONT'D)

- ❑ The ASME/American Nuclear Society (ANS) PRA Standard contains a number of requirements related to characterizing the parameter uncertainty and to calculating the risk metrics.
- ❑ Because the PRA Standard recognizes that the level of detail, the level of plant specificity, and the level of realism needed in a PRA are commensurate with its intended application, the Standard defines three PRA Capability Categories (CCs) that are meant to support the range of applications.
- ❑ The guidance of Steps D-1 and D-2 is provided in a context that also provides direction for meeting the NRC position on those requirements in the PRA Standard that relate to parameter uncertainty.

STAGE D (CONT'D)

- Major changes to the guidance on assessing parameter uncertainty since the March 2009 publication of NUREG-1855, they involve:
 - The scope was expanded from internal events to include parameter uncertainties associated with low power shutdown, internal fire, external hazards, and Level 2 PRA.
 - The NRC position on what is acceptable for meeting the requirements in the ASME/ANS PRA Standard on characterizing and propagating parameter uncertainty has been further clarified.

STAGE D (CONT'D)

- **Step D-1**: The purpose of this step is to provide guidance on quantifying the probabilities (or frequencies) of the basic events and other PRA inputs that are formulated in terms of parameters with underlying uncertainty, and in characterizing that uncertainty.
 - The ultimate goal is to be able to calculate the mean and uncertainty of the risk metrics properly.
 - In order to do that, one has to first correctly characterize the parameter uncertainty associated with the inputs to the PRA. It is especially important to capture the parameter uncertainty of those inputs that constitute significant contributors, i.e., those inputs that contribute significantly to the computed risk for a specific hazard group.

STAGE D (CONT'D)

- **Step D-1 (cont'd)**: What constitutes an acceptable approach depends on the CC:
 - CC I: Point estimates of the basic event parameters are calculated and their uncertainty is characterized qualitatively (e.g., specifying an uncertainty interval).
 - CC 2: Mean values are calculated for the parameters of the SIGNIFICANT CONTRIBUTORS, and the uncertainty is characterized by providing a probabilistic representation of the uncertainty of the parameter values for the SIGNIFICANT CONTRIBUTORS.
 - CC III: Same as CC II but mean values are calculated for the parameters of ALL the PRA inputs, and the uncertainty is characterized by providing a probabilistic representation of the uncertainty of the parameter values for ALL the inputs.

STAGE D (CONT'D)

- ❑ **Step D-2:** The purpose of this step is to provide guidance for quantifying the frequencies and/or probabilities of the risk metrics and estimating their uncertainty due to the propagation of parameter uncertainties through the PRA.
- ❑ In carrying out the propagation, it is important to consider the state of knowledge correlation (SOKC) between events.
 - When the basic event mean values and uncertainty distributions are propagated in the PRA model without accounting for the SOKC, the calculated mean value of the relevant risk metric and the uncertainty about this mean value will be underestimated.
 - The influence or importance of the SOKC on the value of the risk metrics will vary from case to case.
- ❑ Guidance on determining the importance of the SOKC is provided in Section 2.4 of EPRI 1016737, the companion report to NUREG-1855.

STAGE D (CONT'D)

- ❑ **Step D-2 (cont'd)**: What constitutes an acceptable approach depends on the CC and on the importance of the SOKC:
- ❑ **When the SOKC is NOT important:**
 - **CC I**: A point estimate is calculated for the risk metric. An estimate of the uncertainty interval and its basis is sufficient.
 - **CC II**: A mean value is calculated for the risk metric using the mean values of SIGNIFICANT CONTRIBUTORS, and the uncertainty distribution of the risk metric is calculated by propagating the uncertainty distributions of the SIGNIFICANT CONTRIBUTORS through all SIGNIFICANT SEQUENCES/CUTSETS using the Monte Carlo or similar approach.
 - **CC III**: A mean value is calculated for the risk metric by propagating the uncertainty distributions of ALL the input parameters (both significant and non-significant contributors) using the Monte Carlo approach (or other comparable means) through the PRA model, TAKING THE SOKC INTO ACCOUNT. The uncertainty distribution of the risk metrics is calculated by propagating the uncertainty distributions of all the contributors through all retained sequences/cutsets using the Monte Carlo or similar approach and TAKING THE SOKC INTO ACCOUNT.

STAGE D (CONT'D)

- ❑ **Step D-2 (cont'd)**: What constitutes an acceptable approach depends on the CC and on the importance of the SOKC:
- ❑ **When the SOKC is IMPORTANT:**
 - **CC I**: A point estimate is calculated for the risk metric. An estimate of the uncertainty interval and its basis is sufficient. The effect of the SOKC is characterized.
 - **CC II and CC III**: A mean value is calculated for the risk metric by propagating the uncertainty distributions of the input parameters using the Mont Carlo approach (or other comparable means) through the PRA model, ensuring that the SOKC between event frequencies or probabilities is taken into account. The uncertainty distribution of the risk metrics is calculated by propagating the uncertainty distributions of the contributors through all retained sequences/cutsets using the Monte Carlo or similar approach and **TAKING THE SOKC INTO ACCOUNT**.
 - CC II: propagation of the uncertainty only for **SIGNIFICANT CONTRIBUTORS** in the **SIGNIFICANT ACCIDENT SEQUENCES** and **CUTSETS**
 - CC III: uncertainty distribution for **ALL** input parameters is propagated.

STAGE D (CONT'D)

- ❑ **Step D-3**: The purpose of this step is to provide guidance for comparing the PRA results with acceptance guidelines.
- ❑ In this step the determination is made whether the risk results challenge the quantitative acceptance guidelines.
- ❑ The information needed consists of:
 - An estimate of the relevant risk metric(s), usually expressed as the mean value(s),
 - the acceptance guidelines to be used for the particular application, and
 - for some cases the uncertainty interval or distribution(s) of these risk metric(s) is also of interest.

STAGE D (CONT'D)

- ❑ **Step D-3 (cont'd)**: The comparison of the risk metric estimates (usually the mean values) to the acceptance guidelines (usually formulated in terms of mean values) should demonstrate to the decisionmaker whether the guidelines have been met or not, as well as the proximity of the risk results to the guidelines.
- ❑ The uncertainty of the risk metric estimate resulting from the propagation of the parameter uncertainty MAY also be of interest to the decisionmaker:
 - If the risk metric estimate “challenges” or exceeds the acceptance guideline, the uncertainty distribution (or range) can provide useful additional insights.

STAGE D: ASSESSING PARAMETER UNCERTAINTY (APP 6A)

- Objective: to provide an explanation of the SOKC and its possible effect on the mean value and uncertainty distribution of the risk metric.
 - No changes from March 2009 version of NUREG-1855
 - The SOKC stems from the fact that, for identical or similar components, the state of knowledge about their failure parameters is the same.
 - Ideally, each initiating event, equipment response or operator action would have its own database and thus would be statistically independent.
 - In practice, the data used for like components often has some common element, is pooled, or is correlated in some way. For example, the failure rate of one particular LPCI pump is typically based on experience with all “similar” pumps. Therefore, the data used for the pumps is not independent but is correlated.
 - To account for the SOKC, when using a Monte Carlo (or similar) approach to propagate uncertainty, for each pass through the process the same sample value drawn from the probability distribution of the parameter should be used to calculate the basic event probability of all basic events within the correlated data group.

STAGE E: ASSESSING MODEL UNCERTAINTY

- Objective: guidance to the licensee for addressing sources of model uncertainty and related assumptions related to the base probabilistic risk assessment (PRA) and the application PRA.
- The goal is to determine whether (and the degree to which) sources of model uncertainty and related assumptions might cause the risk metric estimates to challenge or exceed the quantitative acceptance guidelines.
- The guidance involves 2 major steps and several sub steps:
 - Step E-1: Identify potential model uncertainties and related assumption and determine their significance.
 - Step E-2: Identify model uncertainties or related assumptions that are key to the decision.
- NUREG-1855 Rev 1 is unchanged from Rev 0 with regard to the treatment of model uncertainties and related assumptions.

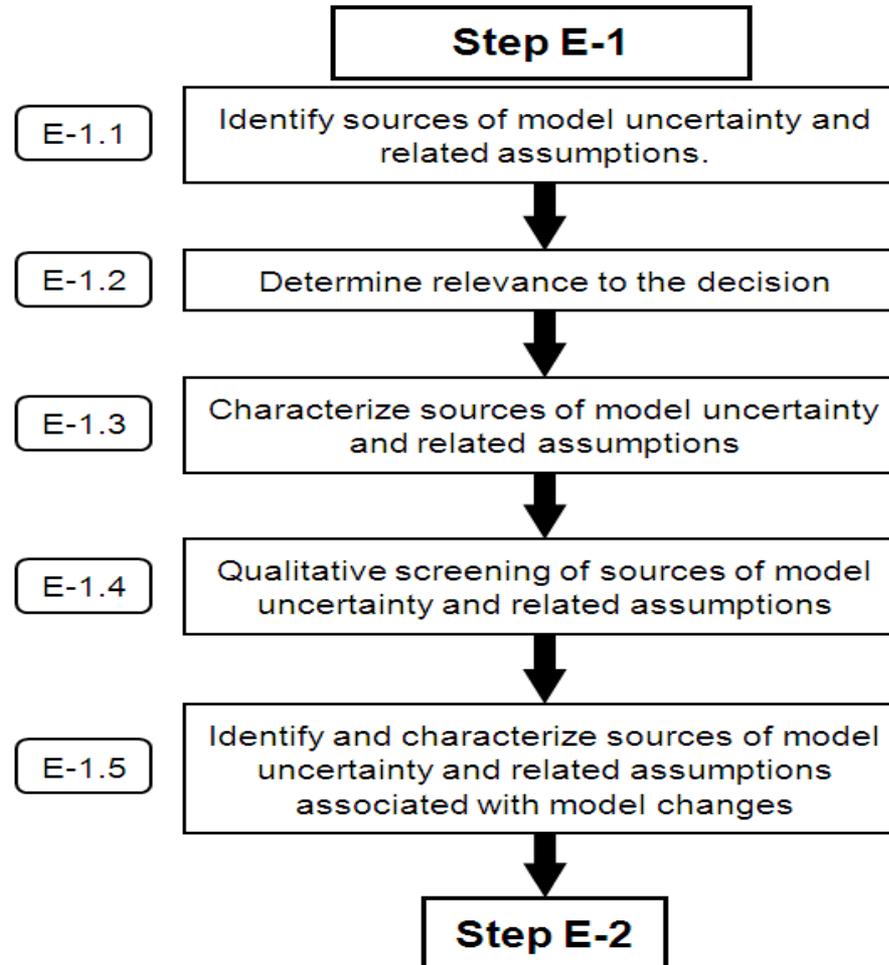
STAGE E (CONT'D)

- ❑ **Step E-1**: Provides guidance to identify and characterize model uncertainties and related assumptions in the PRA required for the application.
- ❑ This process involves the following sub steps:
 - Identify model uncertainties in base PRA
 - Determine relevance of model uncertainties to the decision
 - Characterize model uncertainties
 - Qualitatively screen model uncertainties based on consensus models.
 - Identify model uncertainties introduced by application PRA

STAGE E (CONT'D)

- ❑ **Step E-2**: Provides guidance to identify model uncertainties and related assumptions that are key to the application.
- ❑ For each relevant model uncertainty identified in Step E-1, this process involves:
 - Defining and justifying the sensitivity analyses
 - Define conservative screening, or
 - Realistic sensitivity analysis
 - Performing the sensitivity analyses
 - Use conservative screening in tandem with realistic sensitivity as needed, or
 - Use realistic sensitivity analysis directly

STAGE E (CONT'D)



STAGE E (CONT'D)

- ❑ **Step E-1.1**: Identify model uncertainties in the base PRA
 - Plant specific sources,
 - Generic sources – **EPRI report Tables A-1, A-2.**
- ❑ **Step E-1.2**: Identify relevant model uncertainties in the base PRA
 - Understand the way in which the PRA is used to support the application (Section 3.3, Step A-3)
 - Identifying base PRA sources of model uncertainty relevant to the PRA results needed for the application, e.g.,
 - DG AOT extension, only LOOP sequences need be considered.
 - Risk-Informed Categorization and treatment of SSCs (10CFR50.69) – Involves the entire base PRA.

STAGE E (CONT'D)

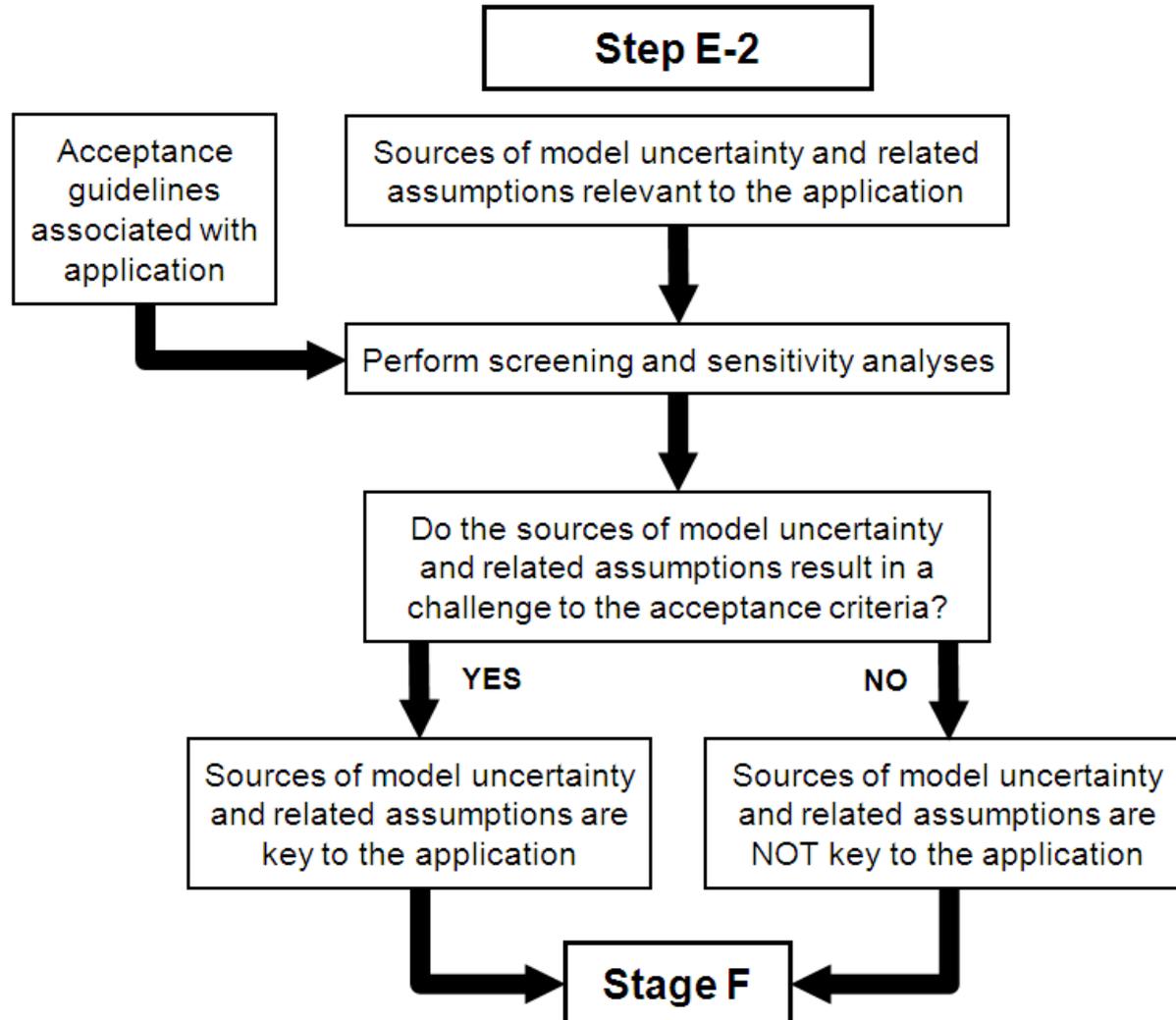
- **Step E-1.3**: Characterize model uncertainties. Identify:
 - The part of the PRA affected, e.g.:
 - a single basic event or multiple basic events
 - the logic structure of the PRA event trees or fault trees
 - a combination of both basic events and portions of the logic structure
 - The modeling approach or assumption used, e.g.:
 - Alternate HRA model may produce different HEPs or introduce new human failure events.
 - Alternate success criterion may lead to a different of system fault tree logic.
 - Use of conservative bias
 - Conservative assumptions in one part of PRA can mask the significance of another part—a part of the model that might be needed for the application.
 - This is true for applications that involve risk categorization or ranking.
 - Thus, if a source of model uncertainty or related assumption is identified as resulting in a conservative bias, the impact of this bias on the conservatism in the PRA should be assessed.

STAGE E (CONT'D)

- **Step E-1.4:** Qualitative screening of relevant model uncertainties
 - Identify and validate whether consensus models have been used in the PRA to evaluate identified model uncertainties.
 - The use of a consensus model eliminates the need to explore an alternative hypothesis. Associated uncertainty is manifested in Stage D risk metric estimates.

- **Step E-1.5:** Identify relevant model uncertainties in the application PRA
 - Apply Steps E-1.1 through E-1.4 to the PRA as modified for the application.
 - **EPRI report Tables A-3 and A-4 provide additional useful information on generic issues.**

STAGE E (CONT'D)



STAGE E (CONT'D)

- ❑ The set of candidate key model uncertainties and related assumptions from Step E-1 are evaluated for the potential to effect a decision.
- ❑ Perform screening and sensitivity analysis
 - Conservative screening can be performed first to avoid more complex sensitivity analyses: e.g.,
 - Compare RAW importance measures against a “maximum acceptable RAW” – based on a base CDF and a maximum allowable CDF acceptance guideline.
 - Approximate bounding evaluation (Step C-1) may be possible, e.g., impact of model uncertainty is limited to the later branches of low frequency accident sequences.
 - Realistic sensitivity analysis:
 - Develop reasonable alternatives or hypotheses associated with the model uncertainties.
 - Alternative or hypothesis is considered reasonable when it has broad acceptance in the technical community and a sound technical basis.
 - To develop the alternatives, an in-depth understanding of the issues associated with the model uncertainty is needed.
 - Examples – use previous experience on other PRAs, parametric variations (e.g., battery life).

STAGE E (CONT'D)

- Screening and sensitivity assessments are discussed for two specific types of risk metric acceptance guidelines:
 - Single risk metric – Case 1 (e.g., CDF)
 - Multiple risk metric - Case 2 (e.g., CDF and Δ CDF)

- Four general types of model uncertainty characterizations (from Step E-1.3):
 - Single basic events
 - Multiple basic events
 - The logic structure of the PRA
 - Logical combinations

STAGE E (CONT'D)

- Logical combinations of model uncertainties
 - Uncertainties associated with various model uncertainties can interact synergistically.
 - The associated sources of model uncertainty are known as a “logical combinations of sources and assumptions.”
 - Importance of HPCI is affected by
 - Frequency of IEs.
 - HEP for depressurization
 - Availability of motor-driven feedwater pumps,
 - Alternate injection systems (e.g., fire water, service water cross-tie)
 - LOOP IE, CCF of DGs and batteries, and recovery of ac power.
 - Field flashing for DGs requires that DGs be restored be for batteries fail.
 - Potential impact of uncertainties associate with HEPs should be assessed together with DC battery depletion uncertainties.
 - **EPRI report Section 4.3.2 – Additional examples.**

STAGE E (CONT'D)

□ Guidance is given for eight subcases

- Case 1a, Single metric, single basic event
- Case 1b, Single metric, multiple basic events
- Case 1c, Single metric, logic structure of PRA changed
- Case 1d, Single metric, logical combinations
 - $RAW_{j,base} > RAW_{max}$
- Case 2a, Double metric, single basic event
- Case 2b, Double metric, multiple basic events
- Case 2c, Double metric, logic structure of PRA changed
- Case 2d, Double metric, logical combinations
 - $(CDF_{j,base}^+, \Delta CDF_{j,}^+)$ and $(CDF_{base}, \Delta CDF)$ are compared to acceptance guidelines

STAGE E (CONT'D)

- Outcome for Stage E
 - Identification of any key model uncertainties
 - An understanding of the potential impact of these key uncertainties on the risk metric estimates

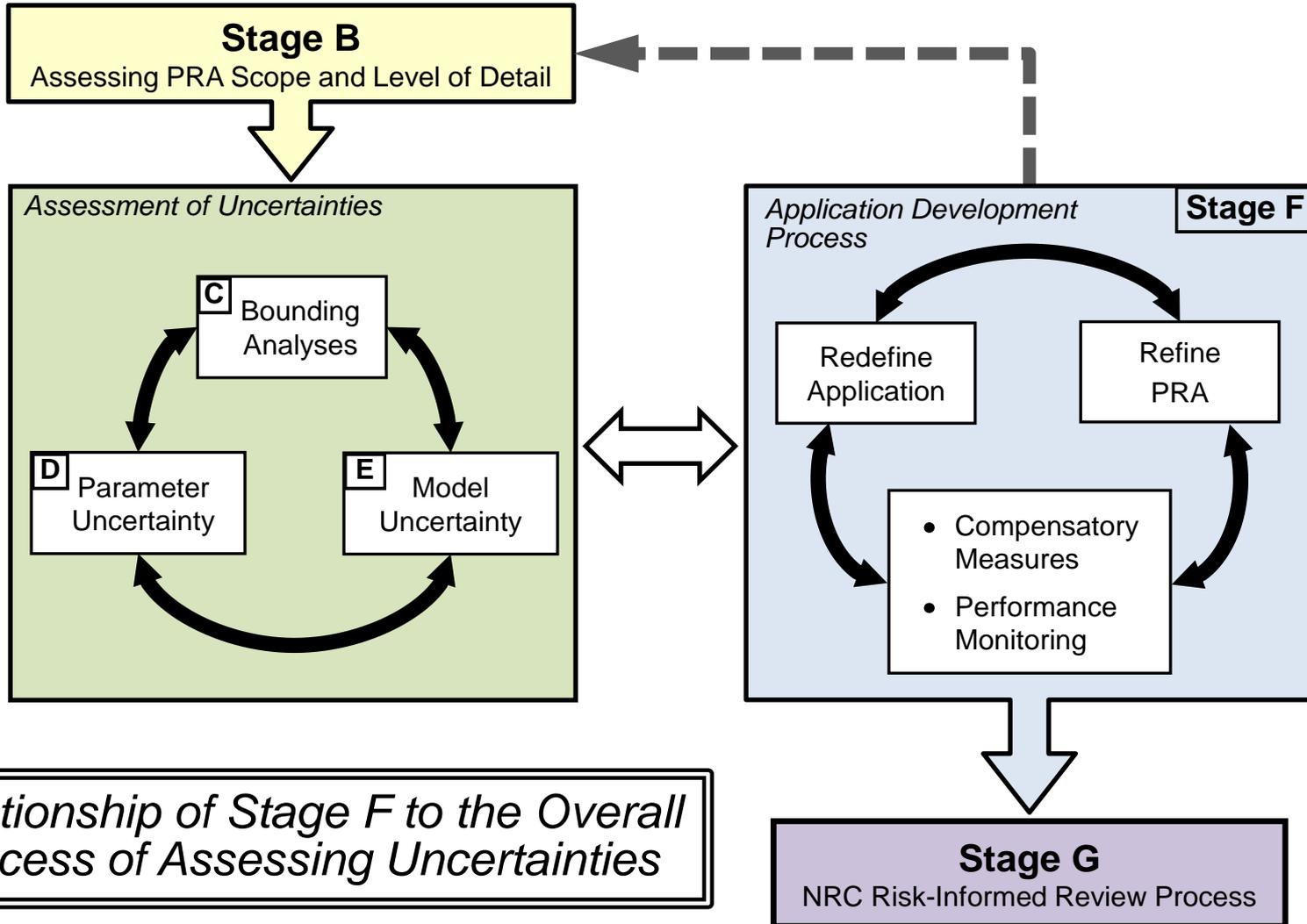
- Licensee's strategy to deal with key model uncertainties is developed in Stage F.

STAGE F: LICENSEE APPLICATION DEVELOPMENT PROCESS

- ❑ Objective: provides guidance to the licensee on the process of developing a risk-informed application submittal, as related to the treatment of uncertainties associated with the application PRA.
- ❑ The purpose of Stage F is to help ensure that adequate justification is provided for demonstrating the acceptability of the risk-informed application.
 - Further, the guidance for this stage helps ensure that the argument for adequate justification of the application is included in the submittal documentation clearly and concisely.
- ❑ Stage F consists of a set of options that are used by the licensee throughout the uncertainty assessment process in determining that adequate justification is provided for the acceptability of the results.
 - redefine the application
 - refine the PRA analysis, or
 - use compensatory measures or performance monitoring requirements.

- ❑ Changes on licensee strategy guidance:
 - This section is a new section
 - Previous NUREG had brief discussions throughout the document and unclear whether guidance was for the licensee or the staff
 - The guidance on the possible strategies is in support of the staff expectations for the licensee justification

STAGE F (CONT'D)



Relationship of Stage F to the Overall Process of Assessing Uncertainties

Option 1 – Redefining the Application:

- ❑ A licensee may choose to redefine the risk-informed application when it is incomplete in its coverage of significant risk contributors.
- ❑ The scope of the risk-informed application can be restricted to those areas supported by the risk assessment.
- ❑ If the risk-informed application is redefined, the licensee should subsequently perform Stage B to reassess the scope and level of detail needed for the redefined application.
- ❑ The licensee should then perform Stages C, D, and E again to determine if and how the impact of completeness, parameter, and model uncertainties has changed for the redefined application.

Option 2 – Refining the PRA:

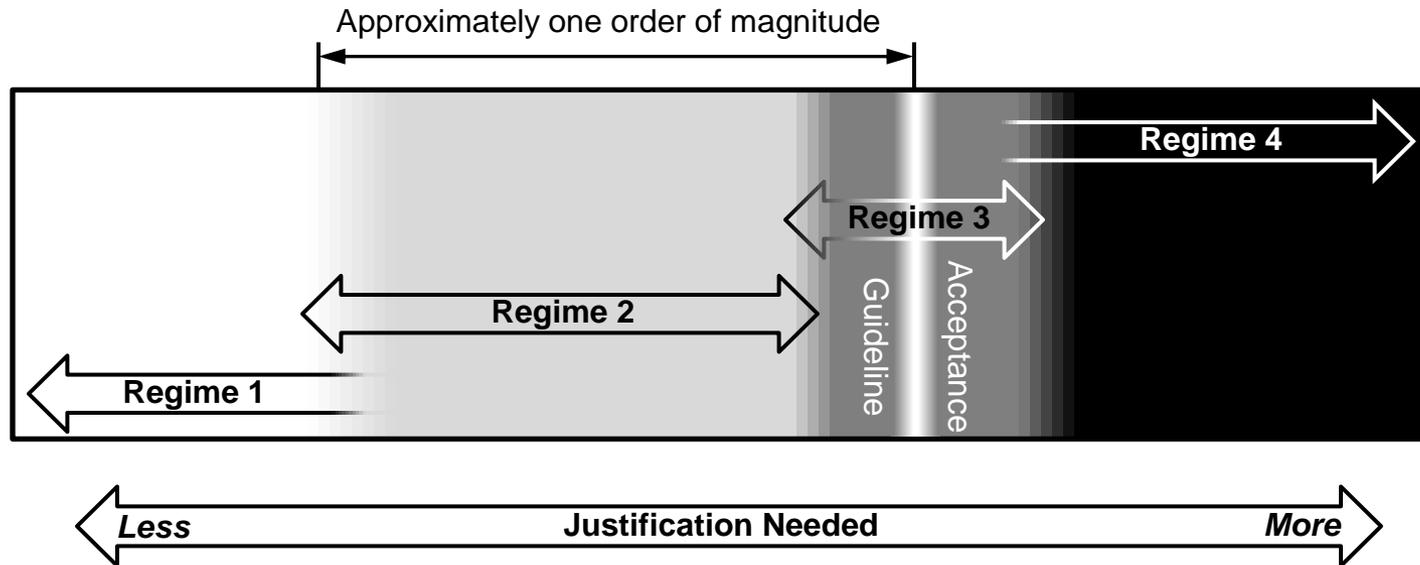
- ❑ A licensee may choose to refine the application PRA to prevent the risk metrics from challenging or exceeding the application acceptance guidelines.
- ❑ If the application PRA is refined, the licensee should subsequently perform Stage D to recalculate the risk metrics and reassess impact of parameter uncertainty on the refined PRA.
- ❑ The licensee should then perform Stage E again to determine the impact of model uncertainty (including any new model uncertainties that were introduced) on the recalculated risk metrics.

Option 3 – Use of Compensatory Measures or Performance Monitoring:

- ❑ A licensee may choose to justify a challenge to or exceedance of the acceptance guidelines by implementing compensatory measures or performance monitoring requirements.
- ❑ Compensatory measures are used to neutralize the expected negative impact of some feature of the plant design or operation on the plant risk.
- ❑ Performance monitoring are used to demonstrate that there is no degradation in those aspects of plant performance that are expected to be affected by the application.
 - Performance monitoring is effective when no predictive model has been developed for plant performance in response to a change.

Preparing the Application Submittal

- The licensee is responsible for ensuring that the acceptability of the application is adequately justified and that the conclusions of the risk assessment are communicated clearly and concisely.



Preparing the Application Submittal (cont'd)

- ❑ When justifying the acceptability of a risk-informed application, the application should demonstrate the following:
 - A clear understanding of the risk contributors and their impact on the results
 - Model uncertainties have been accounted for using the techniques in Stage E
 - The model has sufficient scope and level of detail to support the conclusions of the analysis using the guidance from Stage C
- ❑ Aggregation of risk results may require additional consideration.

Application Submittal Documentation

- ❑ The amount and quality of the documentation that needs to be developed for the application depends on the amount of justification needed and the proximity of the risk metrics to the acceptance guidelines.
- ❑ NUREG-1855 describes several elements of the documentation that should be included in the application submittal, some of which include:
 - A description of the acceptance guidelines that are used for comparison with the risk metrics
 - A discussion of the impact of the parameter uncertainty on the risk metrics
 - A description of the relevant sources of model uncertainty and their impact on the results
 - A description of significant modeling conservatisms

STAGE G: NRC RISK-INFORMED REVIEW PROCESS

- ❑ Objective: describe the process used by the staff to determine whether a licensee's risk-informed application demonstrates an acceptable treatment of uncertainties and that the proposed application represents an acceptable risk impact to the plant.
- ❑ The review process is based on determining whether the licensee has provided adequate justification for the application commensurate with the reliance on the risk analysis in the decisionmaking process and the proximity of the risk results to the acceptance guidelines.
 - In general, more justification will be needed for a given application when the risk results are closer to challenging or exceeding the acceptance guidelines than when the risk results are further away.
- ❑ In determining whether the acceptance guidelines have been met, the staff seeks to answer the following general questions:
 - How do the risk results compare to the acceptance guidelines?
 - Is the scope and level of detail of the PRA appropriate for the application?
 - Is the PRA model technically adequate for the application?
 - Is the acceptability of the application adequately justified?

STAGE G (CONT'D)

□ Changes on staff review process:

- This section has been almost completely revised
- Previous version written by discussing issues that either the licensee or staff needed to address
- Previous version, unclear whether the discussion was guidance for the licensee or the staff
- The approach that is taken by the staff is laid out
- Decision criteria used by the staff is discussed

Completeness Review:

- ❑ Specifically, the staff will assess whether the following criteria are met:
 - the PRA scope and level of detail and the licensee's use of any screening analyses are appropriate for the application
 - the base PRA and changes to the PRA that are used to support the application are technically adequate
- ❑ If the licensee does not provide adequate justification for the exclusion of the missing PRA scope and level-of-detail items (e.g., the licensee provides insufficient justification/screening analyses to show no impact from seismic if they do not have a seismic PRA) the staff will typically reject the licensee's risk-informed application.
- ❑ If the staff determines there is a PRA technical inadequacy of significance that is not sufficiently addressed, the staff will typically reject the licensee's risk-informed application.

STAGE G (CONT'D)

Parameter Review:

- ❑ Specifically, the staff determines whether adequate justification has been provided for the acceptability of the risk results, as compared to the acceptance guidelines.
- ❑ The staff looks at
 - the relevant risk measure(s), usually expressed as a mean value(s)
 - the acceptance guidelines used for the particular application
- ❑ If inadequate justification, the staff will typically reject the licensee's risk-informed application.

Model Uncertainty Review:

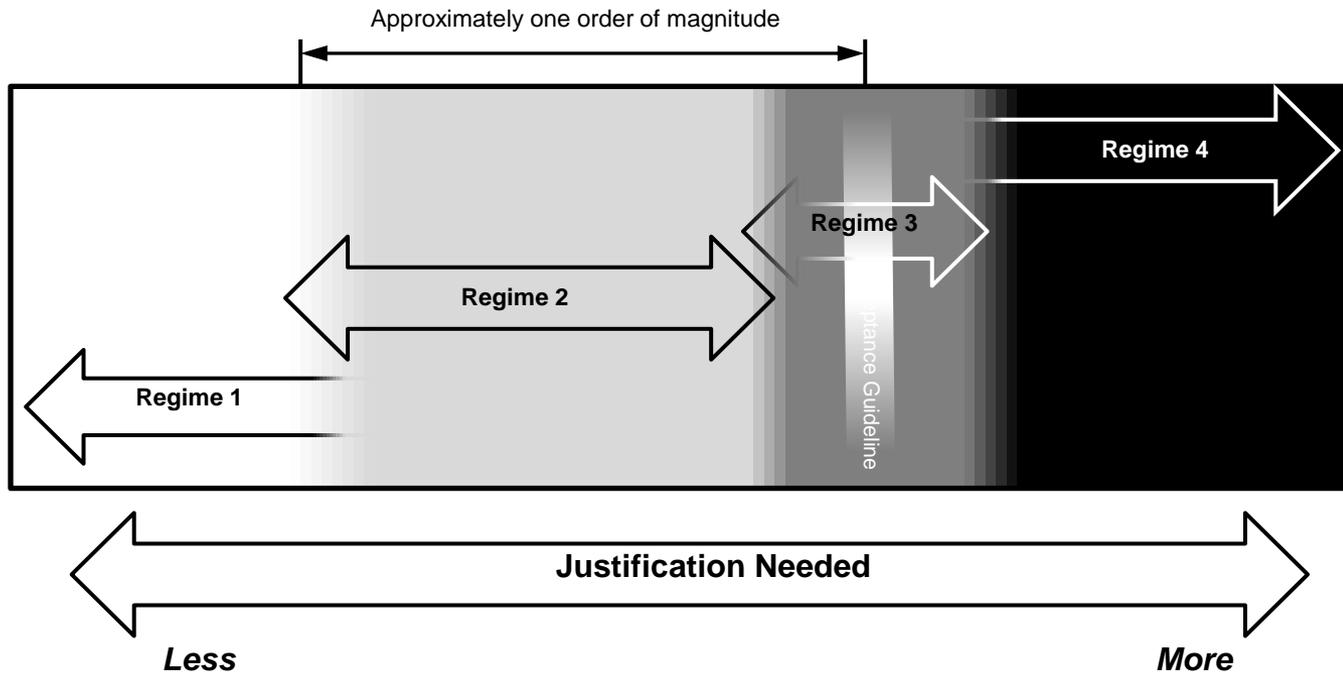
- Specifically, the staff determines whether there is adequate treatment of the model uncertainties by the licensee.
 - Staff determines if the key sources were appropriately identified.
 - Staff determines whether the key sources were adequately characterized and their impact evaluated.
 - If determined that the key sources were not appropriately identified or treated, the staff will typically reject the licensee's risk-informed application.

STAGE G (CONT'D)

Overall Review:

- ❑ Staff review typically begins with technical adequacy check and the comparison of the application risk results to the application specific acceptance guidelines.
- ❑ Justification provided by the licensee is dependent on the significance of the risk results; that is, on the proximity of the results to the acceptance guidelines.
 - Regime 1—The risk results are well below the acceptance guidelines.
 - Regime 2—The risk results are closer to, but do not challenge the acceptance guidelines.
 - Regime 3—The risk results challenge the acceptance guidelines.
 - Regime 4—The risk results clearly exceed the acceptance guidelines.

STAGE G (CONT'D)



STAGE G (CONT'D)

Regime 1:

- Risk results are well below the acceptance guidelines by at least one order of magnitude.
- The staff would review the peer review findings of the licensee's PRA to identify any findings of particular relevance to the application.
- The staff would look for a qualitative or quantitative assessment of the state-of-knowledge correlation (SOKC) showing it does not impact the results of the PRA.

STAGE G (CONT'D)

Regime 1 (cont'd):

- ❑ The staff would look to determine whether the validity of the assumptions made in the application PRA will be appropriately monitored via the implementation of specific performance measurements/strategies (key principle 5 of RG 1.174).
- ❑ The staff would look to see whether degraded performance can be detected in a timely fashion.
- ❑ Finally, the staff would generally not perform an audit on the application PRA when an application is in Regime 1.

STAGE G (CONT'D)

Regime 2:

- Risk results are close to the acceptance guidelines by within one order of magnitude.
- The staff would examine the peer review findings with a higher degree of scrutiny than for applications that fall into Regime 1 so as to better understand how particular findings were resolved as well as the general impact of the findings.
- The staff would look for an quantitative assessment of the SOKC which shows it does not impact the results of the PRA.
- The staff would examine the application to ensure that the proposed performance monitoring is appropriate and adequate for the application and whether degraded performance can be detected in a timely fashion.
- In general, it is unlikely the staff would perform an audit on the application PRA for those applications that fall into Regime 2 unless there is a potentially significant issue raised with one of the above items.

STAGE G (CONT'D)

Regime 3:

- ❑ Risk results challenge, but do not significantly exceed acceptance guidelines.
- ❑ The staff would examine the peer review findings with an even higher degree of scrutiny than applications in Regime 2 so as to better understand how particular findings were resolved as well as the general impact of the findings.
- ❑ The staff would look for an quantitative assessment of the SOKC which shows it does not impact the results of the PRA.
- ❑ The staff would examine the application to ensure that the proposed performance monitoring is appropriate and adequate for the application and whether degraded performance can be detected in a timely fashion.
- ❑ Applications in this regime likely will identify compensatory measures that are not credited in the PRA to show the risk results are less than calculated and staff will review these measures to understand their potential impact and seek some sensitivity analyses on some measures.
- ❑ In general, it is likely the staff would perform an audit on the application PRA for those applications that fall into Regime 3.

STAGE G (CONT'D)

Regime 4:

- ❑ Risk results clearly exceed the acceptance guidelines.
- ❑ Very rare that a licensee would make this type application.
- ❑ Consistent with RG 1.174, the staff would typically not accept these applications. If a licensee justified results were due to conservative or bounding analyses then the staff would have the licensee revise the application to provide and justify more realistic results.
- ❑ If as part of a combined change request, one aspect exceeds the guidelines while another aspect makes the overall risk results acceptable, the staff would, in addition to Regime 3 review:
 - Determine the appropriateness of being a combined change request.
 - Determine the appropriateness of compensatory measures and likely request sensitivity analyses to show risk results are below the acceptance guidelines.
 - Perform a more in-depth audit of the application PRA and peer review findings than would be performed if all aspects were in Regime 3.

STAGE G (CONT'D)

- If accepted by the staff, the risk-informed application is considered to have
 - an acceptable treatment of uncertainties and
 - met the fourth risk-informed decisionmaking principle of posing an acceptable risk impact to the plant
- Conversely, if the staff rejects the application, the risk-informed application is considered to have an unacceptable treatment of uncertainties or poses an unacceptable risk impact to the plant.

- ❑ Objective: Provide an example of the licensee application development process.
- ❑ A hypothetical example is developed, using a realistic PRA model, to illustrate the process described in NUREG-1855 and in EPRI report 1016737.
- ❑ The example has not changed from the one in the March 2009 publication of NUREG-1855, but even more caveats were added:
 - The example is strictly hypothetical,
 - The example is not a template that can be used to justify a similar license amendment request.

□ Stage A : THE APPROACH FOR TREATING RISK ANALYSIS UNCERTAINTIES

- The example is a hypothetical license amendment request (LAR) to revise the Technical Specification Allowed Outage Time (AOT) from 3 days to 7 days for the RHR/SPC system at a representative BWR, Mark II plant. The purpose of the technical specification change is to allow routine preventive maintenance currently performed at shutdown to be performed with the unit at power. The PRA model for the plant is consistent with the PRA technical adequacy requirements outlined in Regulatory Guide 1.200.
- Based on this description, the approach described in NUREG-1855 is appropriate for the example LAR.

□ Stage B: ASSESSING PRA SCOPE AND LEVEL OF DETAIL

- The **acceptance guidelines** and the corresponding **risk metrics** needed are identified. The application specific guidance documents are:
 - Regulatory Guide 1.174, where the risk significance is measured by changes in Core Damage Frequency (Δ CDF) and Large Early Release Frequency (Δ LERF),
 - Regulatory Guide 1.177, where the metrics are Incremental Conditional Core Damage Probability (ICCDP) and Incremental Conditional Large Early Release Probability (ICLERP)
- Needed **scope** and **level of detail**: all POSs, all hazards:
 - At power hazards addressed quantitatively via PRA:
 - Internal Events,
 - Internal Floods,
 - Internal Fires
 - The existing PRA is a detailed PRA, and models the RHR loops in detail (shows cause-effect relationship associated with the LAR): has necessary level of detail.
 - Other POSs and other hazards are missing from PRA scope.

□ Stage C: ASSESSING COMPLETENESS UNCERTAINTY

- Hazards not modeled in the PRA are either screened from consideration or shown to be not risk significant based on a conservative analysis.
- Low power and shutdown POSs are conservatively eliminated since the purpose of the LAR is to allow routine preventive maintenance, currently performed at shutdown, to be performed at power.
- Hazards screened based on low likelihood of threat:
 - Accidental aircraft impact, external floods, extreme winds and tornadoes, turbine-generated missiles, external fires, pipeline accidents
- Hazards screened based on limited role of RHR in their mitigation:
 - Accidents from nearby facilities, release of chemicals stored at site, transportation accidents
- Hazards screened by a bounding conservative analysis:
 - Seismic Events – shown to be negligible by comparison of a conservative seismic analysis with internal events results.

- Stage D: ASSESSING PARAMETER UNCERTAINTY
 - An initial comparison of the risk metrics with acceptance guidelines shows the acceptance guidelines could be exceeded.
 - To address the exceeding of the acceptance guidelines:
 - The fire PRA part of the analysis is refined to eliminate some demonstrated conservatisms,
 - Some compensatory measures are imposed prohibiting maintenance on other significant components.
 - The refined results show that the mean values of the risk measures now meet the acceptance guidelines (without considering the SOKC).
 - The EPRI guidelines are implemented to show that for this case the SOKC is not important for calculating the risk metrics.

□ Stage E: ASSESSING MODEL UNCERTAINTY

- In order to identify the sources of model uncertainty, the important contributors to the results are identified with respect to the sum of the contributions from all hazard groups.
- The examination of the cutsets and Fussell-Vesely and Risk Achievement Worth importance measures reveal that **15** items are important contributors to the change compared to the base case results:
 - Nine Internal Events Important Contributors
 - Six Internal Fire Events Important Contributors
- Based on the identified important contributors **six** sources of **model uncertainty** are identified.
- Based on the important contributors and the sources of model uncertainty identified, **four** individual sensitivity cases are identified for further exploration as **potential key sources of uncertainty**.
- The sensitivity cases indicate that the acceptance guidelines could be exceeded for **two** of these items, which are identified as **key sources of uncertainty** :
 - Human Error Probability (HEP) development as a class
 - The basis for determining CRD survivability following containment failure scenarios

- Stage F: LICENSEE APPLICATION DEVELOPMENT PROCESS
 - An initial comparison of the risk metrics with acceptance guidelines (Stage D) showed the acceptance guidelines could be exceeded.
 - The fire PRA part of the analysis was refined to eliminate some demonstrated conservatisms, and
 - Some compensatory measures were imposed.
 - Sensitivity cases for the key model uncertainties were explored, and additional potential compensatory measures were identified.
 - *HEP development*: Perform pre-shift briefs on potentially important actions.
 - *CRD survivability following containment failure*: Establish actions to consider pre-alignment of alternate injection systems when containment pressures approach the primary containment pressure limit.

STATUS AND NEXT STEPS

- ❑ NUREG is currently going through internal staff review by the program offices (NRR and NRO)
- ❑ NUREG to be released for 60 day public review and comment in mid-August
 - Review and comment period closes mid October
- ❑ Revision 1 to NUREG-1855 scheduled to be published the end of November, 2012



EPRI 1016737 - Treatment of Parameter and Model Uncertainty for Probabilistic Risk Assessments

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June 19, 2012

EPRI Treatment of Uncertainty

- EPRI 1016737 - *Treatment of Parameter and Model Uncertainty for Probabilistic Risk Assessments* (Final Report, December 2008)
 - Developed as complement to NUREG-1855
 - Includes guidance for dealing with parameter and model uncertainty
 - Includes guidance for dealing with SOKC
 - Includes list of potential sources of model uncertainty for internal events
 - To be retained (i.e., new EPRI document will not be an updated version of this report)

EPRI Treatment of Uncertainty

- New EPRI Report
 - Initial draft expected by end of July 2012
 - Supplement to guidance provided in EPRI 1016737
 - Include potential sources of model uncertainty related to:
 - internal fires
 - seismic
 - low power shutdown
 - level 2
 - Includes input from 2012 uncertainty workshop with industry experts
 - Complement to NUREG-1855, Revision 1
 - Provides additional guidance to licensees for preparing risk-informed applications



Backup

2012 Uncertainty Workshop Presenters

- **Workshop Format**

- Presenters chosen to present sources of uncertainty to break-out session
- Break-out session moderated discussion
- Summary presentation/discussion

- **Fire**

- Moderator: Jeff LaChance (SNL)
- Presenters:
 - Ray Gallucci (NRC)
 - Brian Metzger (NRC)
 - Paul Guymer (Jacobson Analytics)
 - Mike Wright (Jacobson Analytics)
 - Mardy Kazarians (Kazarians and Associates)
 - Dennis Henneke (GE – Hitachi)

- **Seismic**

- Moderator: John Lehner (BNL)
- Presenters:
 - Annie Kammerer (NRC)
 - Jim Xu (NRC)
 - M. K. Ravindra (MKRavindra Consulting)
 - Greg Hardy (Simpson Gumpertz & Heger)

- **LPSD**

- Moderators:
 - Gareth Parry (ERIN Engineering)
 - Matt Dennis (SNL)
- Presenters:
 - Ken Kiper (NextEra Energy)
 - Don Wakefield (ABS Consulting)
 - Marie Pohida (NRC)
 - Steve Eide (Sciencetech)

- **Level 2**

- Moderators:
 - Don Vanover (ERIN Engineering)
 - Tim Wheeler (SNL)
- Presenters:
 - Don Helton (NRC)
 - Dr. Richard Denning (OSU)
 - Mark Leonard (dycoda LLC)
 - Jeff Gabor (ERIN Engineering)
 - Ray Schneider (Westinghouse Electric Co.)

Example Table from 1016737

Table A-1
Issue Characterization for Sources of Model Uncertainty

Issue Description		Issue Characterization	
Topic	Discussion of Issue	Part of Model Affected	Possible Approaches (Not Exhaustive)
Initiating Event Analysis (IE)			
1. Grid stability	<p>The LOOP frequency is a function of several factors including switchyard design, the number and independence of offsite power feeds, the local power production and consumption environment and the degree of plant control of the local grid and grid maintenance. Three different aspects relate to this issue:</p> <p>1a. LOOP initiating event frequency values and recovery probabilities</p> <p>1b. Conditional LOOP probability</p> <p>1c. Availability of dc power to perform restoration actions</p>	LOOP sequences	<p>1. LOOP frequencies for the different categories and recovery probabilities based on data from NUREG/CR-6890 [11]. Each LOOP category uniquely represented in the model.</p> <p>2. Different categories merged into single LOOP frequency with weighted average recovery probabilities.</p> <p>3. Update of data for recent experience and use separate analysis to account for plant-specific or regional grid stability issues.</p>
		Consequential LOOP sequences	<p>4. Conditional LOOP frequencies based on NRC recommended values [12, 20].</p> <p>5. Conditional LOOP frequencies based on EPRI expert elicitation values [13] or Owners Group assessments.</p>
		LOOP or consequential LOOP sequences with offsite power recovered	<p>6. Plant-specific features and dependencies accounted for in system modeling of LOOP restoration after ac power recovery occurs.</p> <p>7. Use of generic data assumed to adequately account for availability of dc power to perform restoration actions.</p>