



**UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001**

March 15, 2013

MEMORANDUM TO: ACRS Members

FROM: John Lai, Senior Staff Engineer **/RA/**
Technical Support Branch
Advisory Committee on Reactor Safeguards

SUBJECT: CERTIFIED MINUTES OF THE ACRS RELIABILITY AND PRA
SUBCOMMITTEE MEETING ON NUREG-1855, REV.1,
"GUIDANCE ON THE TREATMENT OF UNCERTAINTIES
ASSOCIATED WITH PRAS IN RISK-INFORMED
DECISIONMAKING", ON OCTOBER 19, 2012

The minutes of the subject meeting were certified on March 7, 2013, as the official record of the proceedings of that meeting. Copies of the certification letter and minutes are attached.

Attachments: As stated

cc C. Santos



**UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001**

MEMORANDUM TO: John Lai, Senior Staff Engineer
Technical Support Branch
Advisory Committee on Reactor Safeguards

FROM: John W. Stetkar, Chairman **/RA/**
Reliability and PRA Subcommittee

SUBJECT: CERTIFICATION OF THE MINUTES OF THE ACRS
RELIABILITY AND PRA SUBCOMMITTEE ON NUREG-1855,
REV.1, "GUIDANCE ON THE TREATMENT OF
UNCERTAINTIES ASSOCIATED WITH PRAS IN RISK-
INFORMED DECISIONMAKING", ON OCTOBER 19, 2012

I hereby certify, to the best of my knowledge and belief, that the minutes of the subject meeting are an accurate record of the proceedings for that meeting.

/RA/ Date **3/7/2013**
John W. Stetkar, Chairman
Reliability and PRA Subcommittee

**ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
MINUTES OF THE ACRS RELIABILITY AND PRA SUBCOMMITTEE MEETING
OCTOBER 19, 2012**

The ACRS Reliability and PRA Subcommittee held a meeting on October 19, 2012 in Room T-2B1, 11545 Rockville Pike, Rockville, Maryland. The meeting convened at 1:00pm and adjourned at 4:54pm. The entire meeting was open to the public. No written comments or requests for time to make oral statements were received from members of the public related to this meeting.

ATTENDEES

ACRS Members

John Stetkar, Subcommittee Chairman
Dennis Bley, Member
William Shack, Member
Joy Rempe, Member

ACRS Consultant

Mario Bonaca

ACRS Staff

John Lai, Designated Federal Official

NRC Staff

Gary DeMoss, RES/DRA
Mary Drouin, RES/DRA
Anders Gilbertson, RES/DRA
Mark Caruso, NRO/DRA

Other Attendees

Mary Presley, EPRI
Jeff LaChance, SNL
Gareth Parry, ERIN Engineering

SUMMARY

The purpose of the meeting is to hear staff's discussion of the treatment of uncertainties associated with PRAs in risk-informed decisionmaking, NUREG-1855, Revision 1, and EPRI staff's presentation on EPRI Draft Report 1026511, "Practical Guidance on the Use of PRA in Risk-informed Applications with Focus on the Treatment of Uncertainties". The meeting transcripts are attached and contain an accurate description of each matter discussed during the meeting. The presentation slides and handouts used during the meeting are attached to these transcripts.

Major Issues discussed during the meeting are described in the following Table.

Table 1. Major Issues Discussed During the Meeting

Major Issues Discussed	
Issue	Reference Pages in Transcript
Chairman Stetkar asked why there are two separate EPRI reports, some of the material is new and some is overlapped. Can they be combined into one? Mary Presley of EPRI replied that they may consider it in a later date.	7-16
Gareth Parry of ERIN engineering discussed the assumptions and process used for assessing uncertainties in risk-informed decision making.	18-26
Chairman Stetkar, Members Bley, Shack, and presenters discussed how the uncertainties should be addressed and applied in the NUREG. Chairman Stetkar noted an example from NUREG-1934 which shows how the treatment of uncertainties can affect decisions about modeling fire damage scenarios. Member Shack stated that uncertainties often were not addressed during development of the PRA model but were added after the model was developed.	27-46
Chairman Stetkar stated that the information for large uncertainties should be made available to decision makers even if the mean (point estimate) value has large margin compared to acceptance criterion.	48-51
Chairman Stetkar cautioned that the reader may interpret the guidance about quantification of uncertainties only for results that are close to the acceptance criteria in an inappropriate way and the guidance may need some refinement.	52-56
Chairman Stetkar and the presenter discussed the merit of performing sensitivity analysis if one already had the quantified uncertainties.	58-60
Chairman Stetkar, Mary Drouin of RES, and Gareth discussed the proposed approach for addressing Defense-In-Depth.	64-69
Chairman Stetkar, Member Bley, Gareth, and Mary Presley discussed the concept of large uncertainties and the meaning of the mean value for data with large uncertainties.	69-78
Chairman Stetkar and presenters discussed that there is a consensus for doing seismic uncertainty analysis but not for flooding uncertainty analysis.	79-81
Chairman Stetkar, Member Bley and presenters discussed the approach and decision-making process to handle the flooding uncertainty analysis.	82-90
Chairman Stetkar stated that performance of sensitivity analyses on the mean value does not address uncertainty. Quantification of a mean value implies that the uncertainty distribution is known. If that distribution appropriately characterizes the actual uncertainty, there is no need to do a sensitivity analysis.	91-92

Chairman Stetkar and presenters discussed the changes made on the discussion of the examples in appendix A of the EPRI report.	96-101
Chairman Stetkar stated that examples given in appendix A may give the readers a false sense of the minimum requirements. In reality, more activities may need to be considered which are not covered in the examples.	101-104
Chairman Stetkar, Member Bley and presenters discussed the contents of the tables in appendices B, C, D, and E and how the examples can be used and linked to the examples in appendix A.	104-109
Chairman Stetkar stated that the uncertainties from using different consensus models (e.g., MELCOR vs. MAAP) were not discussed in appendix E.	110-111
Chairman Stetkar, consultant Bonaca, and presenters discussed the possibility of combining the two EPRI reports in the future and plans to publish the NUREG and the new EPRI report.	112-114
Chairman Stetkar and Mary Drouin discussed why the NUREG and EPRI reports are not combined into one report.	114-115
Mary Drouin discussed the feedback items from the June Subcommittee meeting and changes made to the NUREG.	116-130
Chairman Stetkar asked why the staff is not required to quantify uncertainties in their analyses (e.g., applications using SPAR models), but it is required of the applicants as described in this NUREG. Mary Drouin replied that the staff has narrowly focused on specific applications when they wrote the report.	130-134
Presenters discussed the changes made on the treatment of bounding analysis and on the effect of State of Knowledge Correlation.	135-141
Consultant Bonaca stated that it was a well organized presentation and it should provide help to the industry.	143
Member Bley stated that except for the examples discussed in the meeting, it has come a long way. He was disappointed that not many people from the NRO/NRR technical staff were present in the meeting. Member Shack echoed Member Bley's observations.	143-144
Chairman Stetkar also echoed Member Bley's observations and thanked the staff and EPRI for their presentations. He also reiterated that people may misinterpret those examples as the bare minimum that is necessary and sufficient for risk-informed applications. He suggested that EPRI and staff re-read the report to find where the text can be clarified.	144-146

Table 2. Action Items

ACTION ITEMS	
Action Item	Reference Pages in Transcript
None	

Documents provided to the Subcommittee

1. Draft NUREG-1855, Rev. 1, "Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decisionmaking", NRC-RES, August 2012 (ML12263A407).
2. Draft EPRI Report, "Practical Guidance on the Use of PRA in Risk-Informed Applications with a Focus on the Treatment of Uncertainty", EPRI-1026511, August 2012 (ML122770285).
3. EPRI Report, "Treatment of Parameter and Model Uncertainty for Probabilistic Risk Assessments", EPRI-1016737, December, 2008.

Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards
Reliability and PRA Subcommittee

Docket Number: (n/a)

Location: Rockville, Maryland

Date: Friday, October 19, 2012

Work Order No.: NRC-1966

Pages 1-153

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2 NUCLEAR REGULATORY COMMISSION

3 + + + + +

4 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

5 (ACRS)

6 + + + + +

7 RELIABILITY AND PRA SUBCOMMITTEE

8 + + + + +

9 FRIDAY

10 OCTOBER 19, 2012

11 + + + + +

12 ROCKVILLE, MARYLAND

13 + + + + +

14 The Subcommittee met at the Nuclear
15 Regulatory Commission, Two White Flint North, Room T2B3,
16 11545 Rockville Pike, at 1:00 p.m., John W. Stetkar,
17 Chairman, presiding.

18 SUBCOMMITTEE MEMBERS:

19 JOHN W. STETKAR, Chairman

20 DENNIS C. BLEY, Member

21 JOY REMPE, Member

22 WILLIAM J. SHACK, Member

23 ACRS CONSULTANT:

24 MARIO BONACA

25

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1 NRC STAFF PRESENT:

2 JOHN LAI, Designated Federal Official

3 MARY DROUIN, RES

4 ANDERS GILBERTSON, RES

5 MARK RUSSO, NRO

6
7 ALSO PRESENT:

8 JEFF LaCHANCE, Sandia National Laboratories

9 GARETH PARRY, ERIN Engineering

10 MARY PRESLEY, EPRI
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P R O C E E D I N G S

1:01 p.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 Members in attendance are Dennis Bley, Bill Shack, and Joy Rempe. Our consultant, Mario Bonaca, is also in attendance. John Lai of the ACRS staff is a Designated Federal Official for this meeting.

The Subcommittee will hear discussion of EPRI Draft Report 1026511, practical guidance on the use of PRA in risk-informed applications with focus on the treatment of uncertainties. We'll also hear the staff's discussion of the revised draft NUREG-1855, Revision 1, guidance on the treatment of uncertainties associated with PRAs and risk-informed decision-making.

We've 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 opinions. The Subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, for deliberation by the full committee.

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1 The rules for participation in today's
2 meeting have been announced as part of the notice of
3 this meeting previously published in the Federal Register.

4 A transcript of the meeting is being kept and will be
5 made available, as stated in the Federal Register Notice.

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

11 We'll now proceed with the meeting. And,
12 Mary, I don't know if you want to say anything first.

13 Mary Drouin.

14 MS. DROUIN: Mary Drouin with Office of
15 Research. Well, we're just glad to be back, and we're
16 continuing to move forward. We think this is a very
17 important document and supporting risk-informed
18 regulation. You know, how to deal with uncertainties
19 just is one of the key pieces.

20 CHAIR STETKAR: Mary, just for the benefit
21 of the Subcommittee members that are here, could you
22 just briefly tell us what your plans are for the NUREG
23 anyway, in terms of the near-term --

24 MS. DROUIN: Right now, we have just issued,
25 before we can send something out for publication, we

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1 need to give a two-week advanced notice to our program
2 offices. So the two-week advanced notice letter is being
3 issued right now as we speak, so I would anticipate that
4 this will be out in the next two to three weeks. For
5 public review and comment, we'll go out for 60 days,
6 so we expect to have the public comments in January and
7 then to issue this final in February.

8 CHAIR STETKAR: Great. Thank you. With
9 that, I guess we'll turn over the meeting to EPRI. Mary?

10 MS. PRESLEY: Hi. I'm Mary Presley from
11 EPRI, and I'm here with Gareth Parry from ERIN Engineering.

12 Let's just jump right in. So the first couple of slides
13 you've seen at the last meeting we had, so I'll go through
14 them fairly quickly so we can spend some time on the
15 actual technical details. Quick overview of the project
16 history and our points of collaboration with Mary Drouin's
17 team and then an overview of what's in the new guidance,
18 and we'll actually step through some of those sections
19 and then discuss our next steps.

20 So the EPRI report is complimentary guidance
21 to the Revision 1 of 1855 that's coming out. And,
22 previously, the Revision 0 of 1855 had a complimentary
23 document, EPRI 1016737, that came out together. And
24 that document --

25 MEMBER SHACK: The telltale heart.

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1 CHAIR STETKAR: Ignore it.

2 MS. PRESLEY: Okay. Oh, there we go.

3 CHAIR STETKAR: Just as long as our recorder
4 can hear okay, that's the important thing.

5 MS. PRESLEY: So that previous document
6 focused on providing some guidance on the state of
7 knowledge correlation, particularly using experiences
8 to describe when it's important, how to look for it,
9 and how to assess it. And, also, there was some sections
10 on characterizing model uncertainty.

11 The guidance on state of knowledge
12 correlation is untouched. We're leaving that in 1016737.
13 And in this new document, we're going to update some
14 of the model uncertainty discussion, which we'll discuss
15 later.

16 CHAIR STETKAR: Mary, why, you know -- I
17 can understand documents, but why didn't you simply update
18 1016737? Right now, there's some separate information
19 in 1016737, there's some separate information in whatever
20 the new one is; I've forgotten the number already --

21 MS. PRESLEY: 10267 --

22 CHAIR STETKAR: -- and there's some overlap,
23 and some of the overlap is the same and some of the overlap
24 is morphed a little bit. Does it not create confusion
25 for users, especially in the overlap and morphing areas?

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1 MS. PRESLEY: We tried to map it out in the
2 front of our new document. I think it was a matter of
3 convenience more than anything to have this new document
4 be an update because people are already --

5 CHAIR STETKAR: Or why didn't you bring the
6 state of knowledge correlation stuff into the new document
7 and just surplus the other one?

8 MS. PRESLEY: We could have.

9 CHAIR STETKAR: I mean, you would have had,
10 you know, the state of knowledge correlation in one place,
11 you would have had the new thoughts of model uncertainty,
12 the tables in terms of the internal events model
13 uncertainty issues. I mean, you know, that's just copy
14 and paste. That's production stuff. It just seemed
15 confusing to me to have the two of them, especially with
16 overlap and disjoint things.

17 MS. PRESLEY: I understand. That's a fair
18 comment. We kind of went back and forth on that. We
19 didn't want, we wanted people to read the new guidance
20 and be aware of what the new stuff was.

21 CHAIR STETKAR: Yes.

22 MS. PRESLEY: And we were a little bit worried
23 that if we poured all the old stuff in, the new stuff
24 would get lost. It was kind of six of one, half dozen
25 of the other, but we'll consider that comment again,

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1 only --

2 CHAIR STETKAR: I mean, I just think of people
3 having to work from two documents. If they were absolutely
4 mutually exclusive, you know, I could rationalize that.

5 But given overlap and some additional elaboration,
6 especially in the area of modeling uncertainty compared
7 to the older one, it just, you might want to think about
8 that.

9 MS. PRESLEY: It may make sense to port that
10 over. That was also a public comment we got.

11 CHAIR STETKAR: Oh, was it?

12 MS. PRESLEY: So we'll consider that. I'm
13 not sure, at this point --

14 MR. PARRY: I'm not sure whether we can do
15 it and meet the schedule, but maybe we could consider
16 doing that at a later date, EPRI could consider doing
17 that at a later date just to combine them.

18 MEMBER BLEY: It just seems for the poor
19 folks out in the field trying to use this --

20 MR. PARRY: I know.

21 MS. PRESLEY: Yes.

22 MEMBER BLEY: -- it's going to be tough for
23 them.

24 CHAIR STETKAR: It's also a lot easier going
25 forward, one would think, that if there's any, I hate

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1 to say this with the staff present, but if there are
2 any future revisions to things, and you want to point
3 to updates of methods or something like that, trying
4 to keep two documents coordinated that are referred to
5 from a NUREG or guidance or whatever, this is prone to
6 problems.

7 MS. PRESLEY: Right. Originally, they were
8 mutually exclusive. They were two separate documents.

9 And then we decided, oh, this chapter four seems to
10 be really applicable and we need to update parts of it,
11 so we ported it over. That's where the lines started
12 blurring, but it's a fair comment.

13 MR. PARRY: I think there's another comment
14 that you could also make as to why we have an NRC document
15 and an EPRI document when they're dealing with the same
16 thing and cross reference --

17 CHAIR STETKAR: Well, I was going to ask
18 Mary that, but since you brought it up . . .

19 MR. PARRY: No, I mean, like the fire --

20 CHAIR STETKAR: Yes, why not?

21 MR. PARRY: -- PRA project, for example.

22 CHAIR STETKAR: Why not? And there have
23 been a few NUREGs issued. I mean, the fire isn't the
24 only one. There have been others issued.

25 MR. PARRY: Right.

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1 CHAIR STETKAR: I'll ask the staff. Mary
2 can answer that because I'm sure that decision was made
3 somewhere.

4 MS. PRESLEY: So the previous work also,
5 as you know, has a list in the appendices of generic
6 model uncertainty for internal events --

7 CHAIR STETKAR: At-power.

8 MS. PRESLEY: At-power, yes.

9 CHAIR STETKAR: As opposed to internal
10 events at shutdown, which isn't a new one.

11 MS. PRESLEY: Yes. So internal events
12 at-power. And that, of course, built on prior EPRI work,
13 which is 1013491.

14 CHAIR STETKAR: Or internal events
15 contribution to Level 2, which isn't a new one.

16 MS. PRESLEY: So we've been working with
17 the NRC under an MOU, and there's two particular points
18 of cooperation in this project. One was to take the
19 stages, the steps that 1855 Revision 1 defines and really
20 provide some concrete guidance on how to apply those
21 steps and where the iteration points are, some of the
22 nuance of how you use those steps in an iterative process
23 to put together a license application and perform that
24 analysis. And the second part was, to produce the
25 appendices, we worked with the NRC, we had a joint workshop

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1 where we brought experts in on fire, seismic, low-power
2 shutdown, and Level 2. So those were the two main points
3 of collaboration and, obviously, we were involved in
4 reviewing each other's documents and making sure that
5 there was one coherent story.

6 CHAIR STETKAR: Is it fair to now
7 characterize, since Appendix A has been deleted from
8 1855 and subsumed in Appendix A now of the new report,
9 is it, from a user's perspective, is it fair to kind
10 of characterize 1855 as what ought to be done and the
11 EPRI documents as guidance for how to do it?

12 MS. PRESLEY: It's kind of a user's --

13 CHAIR STETKAR: Or is it not that --

14 MS. PRESLEY: -- guide.

15 MR. PARRY: Yes, it's kind of like that,
16 I think.

17 CHAIR STETKAR: Okay.

18 MR. PARRY: I mean, that was the intent was
19 to not necessarily reproduce all the techniques and stuff
20 that's in 1855 but to show how they fit into a license
21 --

22 CHAIR STETKAR: So if I'm a user, I basically
23 pick up the EPRI documents and I have confidence that
24 if I follow the template that's there, if I can call
25 it that, I'll satisfy the NRC's need to quantify

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1 uncertainties?

2 MR. PARRY: One would hope so.

3 CHAIR STETKAR: Okay.

4 MS. PRESLEY: And we have --

5 CHAIR STETKAR: I'm just trying to --

6 MR. PARRY: Yes. I mean, that would be the
7 intent.

8 CHAIR STETKAR: I'm trying to get down to
9 real practical things. I'm not trying to be --

10 MR. PARRY: No, no, no, that was --

11 CHAIR STETKAR: -- as simple as I'm sounding.

12 I want to understand how somebody out in the field,
13 a PRA practitioner, will understand how this process
14 works. Will they have confidence when they pick up this
15 document that that, indeed, will satisfy the regulatory
16 needs of the NRC in terms of what they need to do to
17 develop a, you know, a risk-informed application with
18 appropriate treatment of uncertainty, and they don't
19 need to go to other guidance.

20 MR. PARRY: Right.

21 CHAIR STETKAR: They don't even need to read
22 the NUREG in principle.

23 MR. PARRY: Right. I think that's correct.

24 But I think the only caveat I would have is that there's
25 no guarantee that an application would be successful

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1 because there could be disagreements, the sources of
2 uncertainty for example, on their characterization.

3 CHAIR STETKAR: Yes, but those are technical

4 --

5 MR. PARRY: Those are technical things,
6 right.

7 CHAIR STETKAR: Those are specific technical
8 issues, like you didn't model this valve or something
9 like that.

10 MR. PARRY: Right.

11 CHAIR STETKAR: But in terms of the basic
12 process and the methods that are used --

13 MS. PRESLEY: I would say that, with the
14 caveat that there's a lot of good detail in 1855 that
15 we don't replicate. We've mapped, we give an overarching
16 framework of how to do the assessment, how to use those
17 steps. And then we refer to specific sections that give
18 detail on how to specifically do parts of the analysis.

19 So we don't replicate. It's really, they're really
20 complimentary. They're supposed to be used, I think,
21 more or less, together.

22 MS. DROUIN: Both NRC
23 reports, well, the NRC report and the EPRI report are
24 supposed to be, as Mary said, complimentary. There was
25 very little duplicate effort in the reports, so you really
need both of them. We had, you know, at one point, was

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1 going to put the detailed example in 1855. After a lot
2 of discussions with EPRI, it did make more sense that
3 it belonged better in the EPRI report because that's
4 really where the examples are really given and the detailed
5 guidance that supports the high-level guidance of what
6 the staff expectations are that's in 1855.

7 MS. PRESLEY: And I'll give you just an
8 example of what I mean by we give a broader framework
9 and they provide the details. In our document, we talk
10 about how you need to make sure you have the right hooks
11 in your PRA model to model the change that your -- but
12 then we referred to 1855 where they provide a rather
13 lengthy list and discussion of what those hooks are,
14 internal events, basic events, like where you look to
15 find those hooks.

16 So this is really the process and the
17 framework, and we map it against the steps in 1855.
18 And then 1855 flushes out some of the technical details.

19
20 CHAIR STETKAR: Okay. I'll have to think
21 about that.

22 MS. PRESLEY: So, hopefully, that will be
23 more clear when you see the flowchart.

24 CHAIR STETKAR: Okay. I'll let you
25 continue.

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1 MS. PRESLEY: So the new guidance really
2 is intended as the nuts to soup --

3 MR. PARRY: Backwards.

4 MS. PRESLEY: Soup to nuts?

5 MR. PARRY: Soup to nuts, yes.

6 MS. PRESLEY: Thank you.

7 CHAIR STETKAR: It's okay. Either way
8 works.

9 MS. PRESLEY: I eat desert first. Yes, soup
10 to nuts approach of --

11 CHAIR STETKAR: You can start making fun
12 of the way he talks, too.

13 MS. PRESLEY: Thank you. I'm just surprised
14 he didn't point it out to me earlier because it was written
15 on my sheet and he saw it. Okay. Anyways, starting with
16 the PRA that you have and incorporating the changes that
17 you need and doing the screening and pulling out the
18 key risk drivers and key sources of uncertainty and then
19 how do you decompose and interpret your results to find
20 out what those key things are, how do you do sensitivity
21 analyses, where do you look, that sort of thing. And
22 then we provide the graded approach on now you have your
23 uncertainties, you've assessed it against these regimes
24 that are defined in 1855, well, how do you really determine
25 which regime you're in and then what do you do once you

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1 figure that out?

2 And then, once you've done all that and you
3 have your quantitative assessment complete, how do you
4 package that together to produce a story that really
5 describes that you have a wholistic understanding of
6 what the risk is and what the uncertainties are? And
7 part of that is dealing with large uncertainties.

8 So that's what the core of the document is
9 about, and then we provide an example implementation,
10 which is Appendix A, which, as you know, was what was
11 planning to be in 1855 prior. We've moved it over here
12 because we referenced it so heavily, it made more sense
13 to put it in this document. And then we added four
14 appendices for the expanded tables on generic modeling
15 uncertainties for seismic, fire, low-power shutdown,
16 and Level 2.

17 So where we are with the document, I'll talk
18 about this a little bit further in next steps, but we've
19 sent out our document for public comments for users'
20 group and also to Mary's group and have received those
21 comments back. And the majority of the comments were
22 in areas of clarification where we were being a little
23 vague or at least not entirely clear. And then you'll
24 see some of -- we've tweaked the document a little bit.

25 That flowchart is one of the areas where we've tweaked

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1 it, and you'll see some of those things as we go through
2 the slides. And I think Gareth will point out areas
3 where we've made some changes in response to those public
4 comments because you got the draft that went out for
5 public comment. So that's the -- okay.

6 So I'll go ahead and hand it over to Gareth
7 Parry from ERIN Engineering.

8 MR. PARRY: Okay. Thank you, Mary. Yes,
9 one of the things that I think we hadn't really made
10 clear when we put the document together what our ingoing
11 assumptions were. So the next couple of slides make
12 that a little clearer, and you'll see, as Mary said,
13 that we changed the process diagram to reflect the comments
14 that we had from the commenters that said but what about
15 this situation?

16 So what we wrote this for was for guidance
17 for licensees who want to make a risk-informed submittal
18 in accordance with guidance documents, such as Reg Guide
19 1.174, not necessarily that one specifically. But as
20 you know, all the risk-informed application documents
21 tend to rely on that, at least in terms of the philosophy
22 of the integrated decision making and the principles.
23 So that's one going-in position.

24 And, in general, most of those submittals,
25 when you read the guidance documents, they require

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1 consideration of all the contributors to risk with a
2 few exceptions. Sabotage is typically excluded. But,
3 significantly, they generally require that you look at
4 all hazards and all POS's, except, of course, for very
5 specific things, like NFP 805 where you're looking
6 specifically at fires.

7 Now, we recognize that, currently, there
8 are very few, if any, licensees that have full-scope
9 PRA. I mean, there may be a couple that have, but,
10 generally, they do not. So we developed the process
11 to facilitate the screening or bounding of the missing
12 scope items from, the items that are missing from the
13 scope of the PRA. So the process is designed to do that,
14 and it compliments to what the discussions in 1855, which
15 also has a whole chapter on bounding and screening of
16 hazards.

17 Clearly, this, I think, was the part that
18 perhaps was missing from the original document that you
19 can bypass these steps if you have a full-scope PRA
20 or if the PRA that you have is adequate for the application.

21 The application only requires that scope. The other
22 thing we wanted to put in here in the document, it's
23 a little separated from the process itself, is we wanted
24 to explore a little bit of the interplay of the principles
25 of risk-informed regulation, particularly the principle

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1 that talked about the limit, the size of the change that's
2 allowed in terms of the change in risk, and the
3 defense-in-depth principle because that has been a little
4 problematic in terms of the way it's been interpreted.

5 So, in general, we would expect to be starting
6 out with a PRA that, as a minimum, addresses internal
7 events and internal flooding as hazard groups. We also
8 expect that the base PRA will have been peer reviewed
9 against the ASME standard and Reg Guide 1.200 Rev 2,
10 so that the technical adequacy of the base PRA is
11 understood, we know if there are any problems associated
12 with it. And the only comment to make about that is
13 that really only addresses the base PRA. Clearly, you'd
14 have to come back to look at the technical adequacy of
15 certain aspects of the PRA that might be specific to
16 an application.

17 So there's an iterative approach here, but
18 the document doesn't really get into that. That's, if
19 you like, parallel activity that you'd expect the licensee
20 to be doing to ensure the technical adequacy.
21 We didn't think this was the right place for looking
22 at that.

23 Okay. So now if we look at the figure, you'll
24 notice that this is different from the figure that appeared
25 in the draft document in which you had. And the difference

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1 is in the first little diamond on the left-hand side
2 that says PRA model adequate, instead of going to step
3 three, now it clicks up and asks the scope question.
4 So this is a bypass of the screening and bounding part
5 of the process if you know that the PRA model you have
6 going in is of sufficient scope to deal with the specific
7 application. And this could happen if it's a full-scope
8 PRA or, say if you're only dealing with fires, that it's
9 a fire PRA.

10 So those are the only, that's the only
11 difference in the figure, except also that these nice
12 little bubbles on here which indicate which steps of
13 the 1855 process are addressed by these particular steps.

14 So rather than talk through the figure at this point,
15 I'll go through the steps one by one, if that's okay.

16
17 Okay. Steps one and two. These are,
18 essentially -- there's absolutely nothing new here.
19 This is the standard stuff that everybody should be doing
20 if they're doing risk-informed application. They've
21 got to understand what guidance documents they're using,
22 which means that they have to have understood the
23 acceptance guidelines; which risk metrics are being used
24 and how they're to be used; which hazards and plant
25 operational states have to be considered. That's the

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1 overall scope. There's the comment again that some
2 applications can be hazard specific; and, therefore,
3 that's very clear in that case. And in some cases, the
4 cause/effect relationship is also specified in the
5 guidance documents. In some of those documents, it tells
6 you what it is you need to do to model the impact of
7 the change. It may not always be the case for things
8 like Reg Guide 1.174. If it's not one of the standard
9 applications, you may have to search for the way to model
10 the change.

11 And step two is, effectively, it's an
12 assumption that you're staffing with the PRA that you
13 have, whatever the scope is, and you're looking at that
14 model to see that it has the right hooks to model the
15 cause/effect relationship. So it has to have the right
16 elements for you to be able to model the change that
17 you're assessing from a risk perspective. And this is
18 NUREG-1855 Stage B. So this is just to remind people
19 that that's where you have to start.

20 Okay. Step three we put in as -- and you'll
21 see this in the way that the example in Appendix A of
22 our document is developed. You have a PRA, so you're
23 going to do an initial comparison of the PRA results
24 for the acceptance guidelines. This is essential if
25 the scope of the PRA doesn't address all the risk

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1 contributors required by the acceptance guidelines.
2 If the scope is, in fact, adequate, then you really don't
3 need to do this, although you might do this as part of
4 step five.

5 The advantage that you get out of doing this
6 is that the -- there's two things really. One is that
7 the quantitative results you get from that give you an
8 indication of the margin that you have to the acceptance
9 guidelines, so it's a good place to start to see if you've
10 got a hope of meeting the guidelines. But perhaps the
11 more important thing, well, definitely the more important
12 thing is that when you look at the results and you analyze
13 them, you'll get an indication of which initiating events,
14 which accident sequences, which functions, systems,
15 components are important for determining the risk metrics
16 that you're going to be using to make the decision.
17 So it's a detailed qualitative understanding of what's
18 driving the risk metrics, and you need this to be able
19 to do the screening and bounding analysis in step five.

20 You need it in any case in the end when you do step
21 four, the screening and bounding. You'll need it also
22 in step five.

23 So one of the things that we put in the
24 document, and it's in chapter three of this document,
25 is, and I'll come back to it a little later on, is a

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1 description of the hierarchical process for analyzing
2 the results of the PRA, to dig deep and understand where
3 the contributors are coming from, and also to understand
4 the level of detail, if there's any conservatism or
5 anything associated with it. We can come back to that
6 a little later.

7 Okay. Step four. The purpose of step four
8 is to give guidance on how you can assess the adequacy
9 of the scope of the PRA you have. So the idea is to
10 look at the missing scope items and investigate, given
11 that you have understood from step three what are the
12 important initiating event sequences, functions,
13 etcetera, whether you can explore whether, based on that
14 knowledge, you can either screen the hazard group, the
15 missing hazard group of PRS out or whether you can bound
16 its contribution to the risk metrics in some ways.

17 Because there's no universal way of doing
18 this, things are going to be different, depending on
19 the application and the plant and the PRA. We can only
20 give general guidance at this point. What Appendix A
21 does, it gives specific examples of approaches that were
22 used for the particular plant for which Appendix A was
23 developed. So you'll see, for example, in that appendix
24 there's what we call a bounding analysis for the seismic.
25 It's bounding in the sense of the path of the earthquakes

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1 on the plant is bounded, not necessarily frequency.
2 So you can't argue that it's bounding overall. The
3 frequency of the earthquakes is considered to be that
4 whichever everybody agrees on, more or less, given that there's
5 a lot of uncertainty on it. But at least there's an
6 accepted frequency of the earthquakes, so the bounding
7 in that case is bounding on the impact.

8 Now, if neither of these can be demonstrated,
9 i.e. that you can't screen or you can't bound, then you
10 have a problem, at least a short-term problem. Either
11 you can construct a PRA model which could be fairly time
12 consuming and probably resource intensive or, if possible,
13 you could also change the way the change you're proposing
14 is to be implemented at the plant and restricted in such
15 a way that the contributions for the missing scope items
16 become negligible.

17 Okay. Now, step five. Once you're
18 satisfied that the PRA you have has a sufficient scope
19 and/or the missing scope items have been effectively
20 bounded by some calculations and demonstrated to be
21 bounded, then what you do is you do the final comparison
22 with the acceptance guidelines. And this really hasn't
23 changed very much, but it's described in chapter four
24 of this report. It follows, largely, the guidance in
25 the previous EPRI document.

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1 What is different, though, is in the latest
2 version of NUREG-1855 NRC has introduced these regimes
3 where they effectively represent a graded approach to
4 the review and the level of detail of the argument you'd
5 have to make to demonstrate that you've met the guidelines.

6 So what we've included in this is a sort of graded approach
7 to addressing uncertainty, depending on where the point
8 estimate lies.

9 CHAIR STETKAR: Let me ask you about that
10 because I was going to, dependent on who came up first.

11
12 MR. PARRY: Okay.

13 CHAIR STETKAR: You came up first so . .

14 .

15 MR. PARRY: We got the short straw.

16 CHAIR STETKAR: Why is it that I should care
17 more about uncertainty only because I'm in regime three?
18 Why shouldn't I care about uncertainties that I've not
19 evaluated that could give me a measurable probability
20 of being in regime three when I thought I was in regime
21 one and a half because of very large uncertainties?

22 MR. PARRY: Yes, I don't think we've
23 precluded that.

24 CHAIR STETKAR: Certainly, you've not --
25 well, you don't preclude anything. You're very careful

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1 about not precluding. I'll come back to my original
2 comments now. If I'm out in the field as a practitioner
3 and I read this guidance, I read this guidance to say
4 I don't need to worry about uncertainty unless I'm in
5 regime three.

6 MR. PARRY: No.

7 CHAIR STETKAR: I'll tell you, that's the
8 way I read it.

9 MR. PARRY: Okay, okay.

10 CHAIR STETKAR: So if you don't want it to
11 be read that way, you ought to rewrite it.

12 MR. PARRY: I'm sure we will. I think what
13 we say is --

14 CHAIR STETKAR: Now, I get the same
15 impression, by the way, from the NUREG, so Mary is going
16 to have to answer that one, also.

17 MR. PARRY: Well, I think what we say is
18 that, as far as parametric uncertainty, we don't really
19 care when they're in regime one and probably not in regime
20 two because we're low enough. But we do say in the document
21 that you really have to look at the model uncertainties
22 even in regime one because they could shift you into
23 regime four. We never take model uncertainties out of
24 the equation. If we don't, if it's not --

25 CHAIR STETKAR: I'll give you, I'll give

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1 you that. Indeed, it does say you need to look at model
2 uncertainties throughout. But this notion of parametric
3 uncertainty, though, is a slippery slope because what
4 is a model uncertainty and what is a parametric
5 uncertainty? Suppose I'm using a fire model to evaluate
6 a flame height, and within that fire model, whether it's
7 an algebraic empirical correlation or, you know, a zonal
8 model or, in principle, a CFD model, there are a number
9 of parameters that are input to that model, all of which
10 have uncertainties. But I don't quantify those
11 uncertainties in that model. I simply put in a nominal
12 value, and I crank out a result. Is that parameter
13 uncertainty? Is it model -- you know, my result from
14 that model doesn't have uncertainty on it.

15 MR. PARRY: No, I would argue that, in those
16 circumstances, if you were using different approximations
17 to calculating that value, that turns out to be more
18 of a model uncertainty than a parameter uncertainty.
19 And I --

20 CHAIR STETKAR: So, for example, the use
21 of the EPRI5 empirical correlation versus a different
22 correlation that might be in whatever the NRC empirical
23 correlation, certainly that is a --

24 MR. PARRY: That's a model --

25 CHAIR STETKAR: -- a source of model, too.

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1 MR. PARRY: Yes, yes. And --

2 CHAIR STETKAR: MELCOR versus MAP, for
3 example.

4 MR. PARRY: Right.

5 CHAIR STETKAR: Which you don't address.

6 MR. PARRY: Okay. We'll skip over that one.

7
8 CHAIR STETKAR: But I'm just trying to
9 understand, honestly, I'm trying to understand this subtle
10 difference between where do we transition from model
11 uncertainty to parameter uncertainty because I've got
12 a wonderful example that I'm going to bring up once I
13 try to understand your --

14 MR. PARRY: Okay. I think, I think what
15 you're saying is correct. You have to be very careful
16 about the way this is defined. And the parameter you
17 think we're talking about are really the probability
18 distribution to put on basic events.

19 CHAIR STETKAR: Yes, okay. And that's
20 important because. Here's my example. I think it's NUREG
21 -- John, help me out -- 1934, the fire? Thank you.
22 NUREG-1934, fire modeling. We had a meeting on it. They,
23 indeed, address model uncertainty and they also address
24 parameter uncertainty within the context of a model.

25 MR. PARRY: Right.

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1 CHAIR STETKAR: There's a wonderful example
2 in there where, if you put mean values through an algebraic
3 equation, you conclude that a flame height does not impinge
4 upon your cables of interest. If you actually quantify
5 the uncertainty distributions on the heat release rates
6 through that same correlation, you conclude that there's
7 something -- don't hold me to the exact percentages --
8 there's a 30-percent probability, because of the large
9 uncertainties, that, indeed, the flame height does hit
10 the cable, which has a tremendous impact on then how
11 you model that whole process.

12 MR. PARRY: Yes.

13 CHAIR STETKAR: I'm not sure where that fits
14 into regimes one, two, and three in this context, but
15 without -- now, you can say, well, that's parameter
16 uncertainty, but it's not in the context of what you
17 just told me because it's not a basic event that you're
18 quantifying state of knowledge correlation through.
19 It's not a model uncertainty in the sense of looking
20 at correlation A versus correlation B. It's looking
21 at the uncertainty and the results from that model and
22 how it would affect your conclusion.

23 MR. PARRY: Yes.

24 CHAIR STETKAR: And I didn't see any of that
25 coming through in this guidance.

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1 MR. PARRY: That's probably true. But I
2 think where we would have to deal with that, and this
3 is something that we'll take into account, would be in
4 the appendices because I think that's where we would
5 need to be clear about sources of model uncertainty --

6 CHAIR STETKAR: Because part of that,
7 actually, is changing the, it could change the format
8 of the logic model and, you know --

9 MR. PARRY: It surely could, yes. Yes, yes.

10 CHAIR STETKAR: -- I mean, you know, how
11 you implement that point three or whatever is mechanics
12 in a sense. But identifying the fact, the only way you
13 do it is actually propagating those uncertainties through
14 it.

15 MR. PARRY: Yes, and those are --

16 CHAIR STETKAR: You know, I don't want to
17 get hung up on the semantics of is it that model or is
18 it parameter because it's a parameter propagated through
19 a model.

20 MR. PARRY: Yes, yes.

21 MS. PRESLEY: But is that something you would
22 perform a sensitivity study on?

23 CHAIR STETKAR: I don't believe in
24 sensitivity studies, so we'll talk about that later.
25 I believe -- no. And the reason for this is I don't

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1 know what a sensitivity study on that mean value means,
2 and I don't know how people use it. Suppose I come up
3 with -- I don't remember what the mean value was. Let's
4 call it two with no units on it. Now, if I did an uncertainty
5 analysis, which I did, I found out that the uncertainty
6 about that parameter gave me a 30-percent probability
7 that, indeed, a flame height would impinge on a cable.

8 If I do a sensitivity study on that value of two, what
9 do I do? Do I increase it plus or minus a factor of
10 two? Well, if I increase it by a factor of two, maybe
11 by doing that it does hit the cable, but maybe it doesn't
12 if the uncertainty is really broad. So do I increase
13 it a factor of ten or a hundred? And then I say, well,
14 gee, that's unrealistic because I had a mean value and
15 what does it mean to increase a mean by a factor of a
16 hundred?

17 So that's why I don't like this notion of
18 uncertainty distributions or sensitivity studies on the
19 mean because it's the mean of an uncertainty distribution.

20 You already have the information. I had that information
21 because I calculated a mean. I calculated the mean from
22 the uncertainties. I knew the likelihood that, indeed,
23 it would exceed a certain threshold.

24 MR. PARRY: I think I would craft sensitivity
25 studies differently then because I think if, in the one

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1 case, you could, by using the mean you've demonstrated
2 that there's no impact. And if you did the uncertainty
3 propagation and you found there was an impact --

4 CHAIR STETKAR: Yes, which is this example.

5 MR. PARRY: -- which is this example, in
6 that case, I would say, well, okay, it does -- if that
7 makes a difference to your application, then you better
8 rethink whether you're doing the right thing when you
9 do the full propagation. And I think that would tend
10 to lead you to do the more detailed analysis for the
11 actual application. If it could affect it, I think you
12 would do the more detailed case, and you wouldn't --
13 because one is a shortcut of the other, right?
14 Substituting the mean values is a shortcut to doing the
15 --

16 CHAIR STETKAR: Right.

17 MR. PARRY: -- full propagation --

18 CHAIR STETKAR: Well, but I mean this notion
19 of if I substitute the mean values and I win, the notion
20 is, to address some of the concerns, you say, well, do
21 a sensitivity study on the mean.

22 MR. PARRY: I wouldn't say that, though.
23 That's not what -- I think your situation is a little
24 different, that you wouldn't necessarily do the
25 sensitivity study on the mean. I think you would --

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1 CHAIR STETKAR: If you had the full
2 uncertainty distribution, there's no reason to do the
3 uncertainty on the mean. You may be saying the same
4 thing.

5 MR. PARRY: Well, that's where we may be
6 saying the same thing, yes.

7 CHAIR STETKAR: Because you, I mean, it
8 doesn't make sense.

9 MR. PARRY: Yes. But even that, you could
10 say, I mean you'd have to have some notion that the mean
11 that you were getting by substituting mean values, I
12 think you'd have to have some idea of whether that was
13 going to be realistic or not if you were going to use
14 it. And maybe the only way to do it is to do the full
15 propagation. I think, I mean, you're bringing up a good
16 point, but I don't know that we can, we can't address
17 all these situations. That's the problem. But I think
18 --

19 CHAIR STETKAR: Well, granted --

20 MR. PARRY: -- is a good one.

21 CHAIR STETKAR: No. Granted, you can't
22 address all the situations. Again, I'll step back to
23 the person, the practitioner who's going to be picking
24 up these documents and saying what do I need to do tick
25 off my box that I can satisfy the regulator that, when

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1 they, you know, when a reviewer has to tick off their
2 box, did they adequately address uncertainties, the answer
3 will be yes, verily, they followed this guidance and
4 did it. And some of the messages, you know, that you
5 convey either through examples -- examples are good,
6 but examples that are focused, you know, only on one
7 experience set sometimes narrow people down a little
8 bit to where they shouldn't. This one from the fire,
9 I mean, it's kind of a classic.

10 MR. PARRY: Yes, yes.

11 MEMBER BLEY: But you see the same thing
12 in other places.

13 CHAIR STETKAR: Oh, yes, you do. I mean
14 --

15 MEMBER BLEY: At least to me, you know, when
16 you sit around this table with the people who are here,
17 I think you kind of know what these things are. But
18 if you're picking up this book, these two books to tell
19 you how to do it and the books kind of say parameter
20 uncertainty is not important --

21 MEMBER SHACK: Well, but in John's example,
22 what worries me more is the fact that the uncertainty
23 is something that you add to an existing PRA. It seemed
24 to me if I had the PRA and I'm dealing with the uncertainty,
25 John's thing sort of has to be built into the PRA as

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1 he's developing the model. I'm not sure how, you know,
2 here we are with a given PRA and we're somehow trying
3 to divine the uncertainty, whereas in his model the guy
4 that's done the mean value has already set up the model,
5 he hasn't included it, and he's set up his success criteria
6 and everything and he's often, now, somehow, he's missed
7 things.

8 CHAIR STETKAR: Well, he's missed things,
9 but, I mean, part of this guidance says that, for particular
10 applications, you may have to go back and change the
11 structure of your model, you know. And this is a piece
12 of information, without doing that, you wouldn't know
13 that you'd need to change it.

14 MEMBER SHACK: Maybe that's when you go back
15 and you look at the model for that application that you
16 find that out.

17
18 MR. PARRY: I think one of the things that's
19 coming through, to me anyway, is that we need to have
20 a statement in there about the distinction between
21 parameter and model uncertainty because I think, I mean,
22 I can see where you're -- in fire, in particular, and
23 maybe in other places, too, some of the probabilities
24 that we put in the logic models are derived from models
25 that are not simple. I mean, all the stuff, like failure

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1 rates and things like that, those are statistical things
2 that you get from it, and that's really, in a sense,
3 what we were talking about here.

4 CHAIR STETKAR: And that's why I was trying
5 to, you know, through provoking, is trying to understand
6 because there are a couple of different notions of model
7 uncertainty. One is comparing MAP versus MELCOR or,
8 you know, CFAST versus MAGIC or whatever. The other
9 is the results of a modeling process, the uncertainty
10 in those results because of treatment of input parameters,
11 you know, or correlations, whatever. And that's sort
12 of missing. That's between the two notions.

13 MR. PARRY: I think that's a good thing that
14 we probably ought to add something in there to clarify
15 that, and I think that would --

16 CHAIR STETKAR: And a simple example. I
17 mean, I'd go look in that NUREG. It's --

18 MR. PARRY: Okay. What's the NUREG again?

19 CHAIR STETKAR: 1934.

20 MS. DROUIN: I would like to offer that I
21 do think some of this is in a 1055 where we have a chapter
22 where we go into quite some detail, you know, describing
23 parameter uncertainties and model uncertainties. So
24 I would really suggest that we revisit some of this stuff
25 that is there, you know. The problem is is that, as

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1 you move along in the process, you know, you will have
2 explained something earlier in a chapter or two chapters
3 earlier and then you forget about some of these things
4 that were already there.

5 CHAIR STETKAR: Well, and that's another
6 reason, Mary, is that, again, as a practical user, the
7 person out there developing the fault trees and event
8 trees and stuff, if the guidance or the public interactions
9 or, you know, if there are workshops or whatever, focuses
10 primarily on the EPRI document as how to do it. At that
11 final point, the process needs to be very, very sensitive
12 to how the user will interpret both the words and the
13 examples and make sure that they capture the broader
14 stuff from the top because the typical user isn't going
15 to go back and read every page in 1855.

16 MS. DROUIN: But I would like to think,
17 because of the way the NUREG is structured and the way
18 the EPRI document is structured, I personally don't see
19 how that can really happen. If I was a licensee and
20 I saw a NUREG that has a chapter written by the NRC that
21 says here's the strategy you should be using and here's
22 how the NRC is going to review what you've put in, I
23 think I would pay close attention to that.

24 CHAIR STETKAR: Well, let me say --

25 MS. DROUIN: And I would view that --

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1 CHAIR STETKAR: -- let me just tell you --

2 MS. DROUIN: -- along with reading the EPRI
3 document, which has given me some examples.

4 CHAIR STETKAR: Well, but some examples
5 carry a message. What those examples are carries a
6 distinct message.

7 MR. PARRY: Yes, we need to look at, re-look
8 at the NUREG-1855 and make the appropriate references.
9 But it's a point well taken because I think it could
10 be misunderstood, and I think people do tend to think
11 they understand stuff without actually understanding
12 the subtleties of what's going on very often.

13 MEMBER SHACK: Well, I think the whole notion
14 of a consensus model kind of leads to that kind of attitude
15 that, if I'm using a consensus model --

16 CHAIR STETKAR: I'm using a consensus model.
17 A consensus model -- we've had V&V on all five of those
18 fire models, whatever they are. There's reports saying
19 yea, verily, within the constraints of, you know, use
20 these models, they're good. But that V&V didn't talk
21 anything about uncertainty analysis. In fact, the NUREG
22 that talked about the models didn't talk about anything
23 on uncertainty analysis, you know, until they were
24 pressed, for example. So that everybody who knows now
25 that it's the right model and you go to this place and

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1 you look up the parameter values and you take a mean
2 value and means are good, you don't use medians, you
3 know, it's excessively conservative to use the 98th
4 percentile and all of that kind of stuff.

5 MEMBER BLEY: I just went back and peeked.
6 I didn't peek at the whole document, I couldn't, but
7 where parameter uncertainty and model uncertainty are
8 defined. And John's example is a nice one, and there's
9 a distinction that I'm not sure is made between parameter
10 uncertainties on things like valve failure rates where
11 we have extensive data and they're actually reasonably
12 narrow to parameters of physics models where it's really,
13 you could argue whether that parameter uncertainty you
14 described is parameter or if it's hiding some aspects
15 of modeling --

16 MR. PARRY: Right.

17 MEMBER BLEY: -- or it's just, it's quite
18 broad because it's a physics parameter under conditions
19 that aren't narrowly enough defined that you have to
20 cover a wider range. And I'm not sure that jumps out.
21 There's great discussions, but it's a neat example because
22 of that.

23 MR. PARRY: It's a good example.

24 CHAIR STETKAR: I mean, when you think about
25 convolution of full-sized hazard crews with the real

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1 uncertainty on the fragilities rather than some surrogate
2 mean curve or something like that is another -- I mean,
3 you know how to do it mechanically but people don't do
4 it.

5 MEMBER BLEY: In a physics parameter, you
6 get that kind of thing.

7 CHAIR STETKAR: Yes, any kind of natural
8 or physics. You're right.

9 MEMBER BLEY: Or chemical. A natural
10 parameter.

11 CHAIR STETKAR: Yes.

12
13 MS. DROUIN: But I would really put it to
14 the committee, and I'm not trying to discount what you're
15 saying, I'm truly not. I'm coming from a purview of
16 practicality, trying to get something out the door with
17 not a lot of resources and we're running out of time.

18 Is this a fatal flaw to this document? You know, we
19 can continually improve, improve, improve, and I
20 certainly, you know, understand that. But is this
21 something that makes this document difficult and has
22 a high potential for misuse? I would say, no, it doesn't.

23 Now, that's my personal opinion, you know. I recognize
24 these things, but I've got to come back and look at this
25 from a practical perspective.

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1 MEMBER BLEY: We'll have to think about that
2 a little bit. Actually, over all possible applications,
3 is there a high chance of misuse? Probably not. Over
4 cases where you're focusing on the kind of problem that
5 was described here, yes, maybe it is. We'd have to think
6 about that some more.

7 MR. PARRY: I certainly think we can add
8 something into this document to clarify what we mean
9 when we make these statements.

10 MEMBER BLEY: And if you had examples of
11 this kind of thing over in the EPRI document, I think
12 that would go a long way.

13 CHAIR STETKAR: It doesn't take, it doesn't
14 take many examples. It takes, like, one that you say,
15 hey, think about this kind of thing.

16 MEMBER BLEY: And a story with it that
17 generalizes that one example.

18 MR. PARRY: We might, as Mary pointed out,
19 we may have some examples in the Appendices B through
20 E, not A.

21 CHAIR STETKAR: Well, those are just tables,
22 though. And that's --

23 MR. PARRY: Well, I know, but there is issues
24 and they describe what --

25 CHAIR STETKAR: Yes, that's right. I mean,

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1 you're right.

2 MR. PARRY: So we'll check to see what --

3 CHAIR STETKAR: Check to see.

4 MEMBER REMPE: Maybe elaborate kind of the
5 descriptions of the tables. I'm thinking of, like, the
6 one --

7 CHAIR STETKAR: Well, but, I mean, the whole
8 purpose of those tables, though, isn't to try to get
9 too specific.

10 MEMBER REMPE: Yes, but if they spurred it
11 a little bit more with a little more detail, maybe it
12 would cover it.

13 CHAIR STETKAR: Okay. We've probably spent
14 -- I think you hear it.

15 MR. PARRY: Yes, yes. No, no, it's good.

16 CHAIR STETKAR: Back to this thing, though.
17 I mean, honestly, you may want to think about some of
18 this because I did get the impression that one should
19 pay, you know -- you even have the approximately two
20 times little multiplier on this thing here, that as long
21 as my mean value is about a factor of two below my acceptance
22 criteria I don't really need to pay much attention to
23 uncertainty analysis.

24 MR. PARRY: That's not what it says.

25 CHAIR STETKAR: You may want to read that

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1 --

2 MR. PARRY: That's not what it says.

3 CHAIR STETKAR: Okay.

4 MR. PARRY: What it says is that's really
5 related to parameter uncertainty and whether you need
6 to do the full propagation of the state of knowledge
7 correlation. That's the only thing that relates to that.

8 CHAIR STETKAR: Okay.

9 MR. PARRY: And even that factor of two is
10 sort of fuzzy because, in some cases, it's pretty obvious
11 that you have to do it because you've got a lot of problems.

12 You know, a lot of your cut sets have these correlated
13 things. So it's not intended as that at all. It's purely
14 for the propagation of --

15 CHAIR STETKAR: You know, let me give you
16 an example.

17 MS. PRESLEY: Is there a specific thing that
18 gave you that impression?

19 CHAIR STETKAR: Yes. Step, you know, on
20 page 27, step five, final comparison with acceptance
21 guidelines. There's a statement that says, "The rigor
22 with which the uncertainty analysis is performed is a
23 function of the closeness to the acceptance guidelines.

24 For example, if the analysis of model uncertainty does
25 not result in a challenge to the acceptance guidelines,

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1 a rigorous acceptance of the parameter uncertainty may
2 not be needed." I don't know what that last sentence
3 means, but the first sentence seems to give me --

4 MR. PARRY: No, that's purely referring to
5 the propagation of uncertainty. It's only the parameter,
6 that's only the statement knowledge correlation stuff.
7 That's the only thing that's intended to reflect.

8 MS. DROUIN: The reason this figure was
9 created is we sat down with NRR and NRO with quite a
10 bit of time for them to explain to us the actual ways
11 they do the review, how they attack it, how they approach
12 it.

13 CHAIR STETKAR: I understand that, but,
14 quite honestly, they don't know and they don't care about
15 uncertainty. That's one of the problems we have in this
16 agency, and it's got to stop, Mary. You know, I realize
17 that they want a simple-minded way out.

18 MS. DROUIN: Yes, they do.

19 CHAIR STETKAR: And we can say that. So
20 I understand the feedback you're getting from NRR and
21 NRO. I understand that.

22 MS. DROUIN: And I don't think that they
23 discount uncertainties. I think what we're trying to
24 do is find a practical way to deal with them and to try
25 and illustrate that it is going to be, you know, commiserate

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1 with where are they in terms of the acceptance guidelines.

2 And that's a philosophy that this agency has had, you
3 know, since we started bringing risk insights into play
4 that, you know, the closer you are to your acceptance
5 guidelines the more justification you're going to need.

6 And so this is, all this is trying to communicate is
7 that, you know, when you're in regime one and you have
8 taken into account your uncertainties and you're in regime
9 one, you're not going to need to provide as much
10 justification. But as you approach, you know, regime
11 three, we're going to take a very close look, we want
12 to have a very good understand about your uncertainties.

13 CHAIR STETKAR: But, I mean, we're living,
14 we need to stop thinking about error factors of, like,
15 three for pump failure rates and X to the fourth, you
16 know, for pumps for state of knowledge correlation because
17 we're entering a time in risk assessment and use of
18 risk-informed applications that are addressing, and we'll
19 eventually get to your work on large uncertainties --

20 MS. DROUIN: Well, I don't know where that
21 2X came from.

22 CHAIR STETKAR: -- we're dealing with a lot
23 of things like fires, flooding, seismic events, those
24 types of things that, by definition, have large
25 uncertainties associated with them. And when you say,

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1 well, I'm in regime one because I've accounted for my
2 uncertainty, if I've accounted for my uncertainty in
3 the mean sense and I'm in regime one, but my uncertainty
4 is so large that there's still a 10-percent chance that
5 I might exceed my acceptance guideline, that might be
6 okay for a decision-maker to have that information.
7 The decision might be that's fine, but the decision-maker
8 ought to have that information that there's a 10-percent
9 probability that I might exceed the acceptance guideline,
10 despite the fact that I've got large margin on the mean.

11 And that's the kind of thing that I'm talking about,
12 the message that this sends, that's being derived from
13 level one and internal events only core damage frequency
14 world of PRA to something that's going to be applied
15 going forward, you know, maybe over the next decade or
16 so, and be pointed to as guidance for how to think about
17 things that way. Now, I always use the financial stuff.

18 If my financial advisor had told me in 2006 that there
19 was a five-percent probability that I would lose 40 percent
20 of my net worth, I might have made different --

21 MS. DROUIN: Absolutely.

22 CHAIR STETKAR: -- investment decisions,
23 even though their best estimate was that I would gain
24 money, right?

25 MR. PARRY: I think there's two things that

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1 I'd like to point out here. First of all, that statement
2 in 2.7, on page 2.7, I think we can link forward to section
3 4.2 because I think it's explained better there, and
4 that's the intent of it. But the other point that I
5 see you straying towards is really looking at whether
6 we should be even changing the acceptance guidelines
7 because you're now worried about how much --

8 CHAIR STETKAR: No, no, I don't want to muddy
9 that. No, no, no.

10 MR. PARRY: Okay. Well, it sounded like,
11 to me, that you were because really, in a sense, even
12 if we have a tail that crosses the acceptance guidelines,
13 that's not the way --

14 CHAIR STETKAR: We're talking about
15 risk-informed decisions here, and, indeed, you know,
16 both the NUREG and the EPRI document do a very good job
17 about the notion that that's not just based on a number
18 out of the PRA. It's based on five principles, and it's
19 integrated. And in that sense, I'm not talking about
20 changing the acceptance guidelines. I'm talking about
21 developing risk information for that decision that
22 appropriately represents both an expected value, mean
23 value if you want to call it that, and information about
24 if the uncertainty is broad and it might give you some
25 probability that you do not meet the acceptance guideline,

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1 that information, so the decision-maker can look at that
2 and say, well, I still feel confident we have the ability
3 to make a reasonable assessment that, for a variety of
4 reasons, the decision is okay, despite the fact there's
5 a small probability that it might be exceeded. And that's
6 the whole notion of this, you know, the gray area there
7 anyway. So, no, I'm not --

8 MS. PRESLEY: I think that's exactly why
9 we have chapter five, and maybe some of these discussions
10 will be more --

11 CHAIR STETKAR: Chapter five is --

12 MS. PRESLEY: -- directed because that's
13 really, you're in those areas when you have large
14 uncertainties and when you're dealing with things
15 important to defense-in-depth. So in terms of coming
16 up with an application and a story that holistically
17 represents your real risk profile and what you're worried
18 about, I think that's what we strive to explain in chapter
19 five. So maybe some of this discussion will come up
20 again when we --

21 CHAIR STETKAR: Yes, let's --

22 MS. PRESLEY: -- go forward, if that's okay.

23 MR. PARRY: Yes, that's fine. But I do think,
24 though, that, you know, we've thought about this back
25 in the day when we were developing Reg Guide 1.174 is

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1 what should the metrics be and should we have a guideline
2 that said that you've got to be less than this with X
3 percent confidence. That is really, really difficult
4 when we're dealing with very small numbers.

5 CHAIR STETKAR: Sure.

6 MR. PARRY: So it was decided back then that
7 we shouldn't, that we wouldn't do that. So I'm not sure
8 what you do with that information or what anybody would
9 do with that information.

10 CHAIR STETKAR: I'm not sure what you do
11 with that information. Now, I'm not trying to make that
12 -- I think that's beyond what we're talking about.

13 MR. PARRY: Okay.

14 CHAIR STETKAR: I would like people to have
15 the information, though, so that they can think about
16 it.

17 MR. PARRY: Okay.

18 MS. PRESLEY: And I think that's within the
19 guidance, though, chapter five.

20 MR. PARRY: Yes, we do have the percentiles
21 and stuff on that.

22 MS. PRESLEY: Well, and also the quality,
23 I mean, the qualitative stuff that you do for large
24 uncertainties.

25 CHAIR STETKAR: Chapter five, we'll get to

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1 chapter five. Chapter five, by and large, I think is
2 actually really good. It's just the other parts that,
3 again, if I'm picking up this document as a user, PRA
4 group leader out at a utility instructing, you know,
5 the people who work for me or myself, what message is
6 this telling me?

7 MS. PRESLEY: We'll take another look at
8 it for the tenor of, I mean I think we have a good idea
9 of what the issues are, and make sure that we're conveying
10 what we actually intend to convey.

11 MR. PARRY: Right. Could I ask for a short
12 break?

13 CHAIR STETKAR: You can. We were going to
14 break later, but you can do that. Let's take a -- until
15 2:25 we're recessed.

16 (Whereupon, the foregoing matter went off
17 the record at 2:07 p.m. and went back on
18 the record at 2:22 p.m.)

19 CHAIR STETKAR: We're back in session.

20 MR. PARRY: Okay. So we were, we showed
21 the diagram of the regimes and sort of talked a little
22 bit about how we were going to use that. Okay. So we're
23 on this slide now, which is slide 14. And, actually,
24 this just repeats what I said earlier is that, basically,
25 when the results are far from the acceptance guidelines,

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1 parameter uncertainty, in the sense that we talked about
2 it, like valves and pumps and all that sort of stuff,
3 is generally unimportant, except in some cases where
4 it's obvious that it is important. So maybe that's an
5 obvious statement, but this is just based on the experience
6 that we have with doing PRAs for various applications.

7 So in that case, just the substitution of mean values
8 in the cut set equation is probably adequate to get the
9 mean.

10 But we also think that, if you're getting
11 close -- and the reason we set this factor of two is
12 that the way the NUREG was written it said things like
13 from below an order of magnitude to slightly below or
14 slightly above the acceptance guideline as defining regime
15 two, so we wanted to put some more specificity on slightly.

16 And we figured that a factor of two was a good place
17 to start, even though it's not a definitive criterion.

18 But, certainly, if you are within a factor of two, it
19 would be wise to do the full propagation, if you could.

20
21 CHAIR STETKAR: Again, I'd caution you, when
22 I read this, I read it with a very cynical view, obviously.

23 And I look for things where people will point to something
24 and say I don't need to do it because I am 2.5, and they
25 said it's only important if I'm within 2 or 3. Now,

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1 again, I'd just caution you to read it with that -- you
2 can't read it, because you wrote it, with that degree
3 of cynicism, but someone can somehow. The problem is
4 a lot of the public comments you get might not do that
5 either.

6 MR. PARRY: Right.

7 MS. PRESLEY: If we link it back to where
8 we got the guidance from, because a lot of that is from
9 1016737, of how much, where you're looking and where
10 it's important and how much of an impact it's made in
11 those cases, I think if we link it more closely to that,
12 maybe porting that section back into this document --

13 CHAIR STETKAR: Some of those examples in
14 the appendix on 1016737 are good examples.

15 MS. PRESLEY: Yes. But I agree. We'll go
16 back and look at it and make sure we're not --

17 MR. PARRY: You know, and I agree, you know,
18 anything you write can be misused, misinterpreted because
19 nobody reads the small print, typically --

20 CHAIR STETKAR: Well, they read the small
21 print, but they read it if it's in their best interest.

22 MR. PARRY: Yes, yes, okay. That's a good
23 point. I think we just need to make sure that that isn't
24 used inappropriately as much as we can. But the next
25 point that's important is that, since the model

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1 uncertainties may be large, and these are usually the
2 big things, so they've got to be assessed for all regimes,
3 basically. And what we've done is to provide, we've
4 done in this document, in chapter four, is to reproduce
5 the guidance that we had in the old EPRI document, which
6 is what you were saying that maybe we shouldn't have
7 done --

8 CHAIR STETKAR: Let's say there was
9 substantial overlap there.

10 MR. PARRY: Yes. So we haven't changed the
11 process any, but it's the way in which we refer to the
12 different appendices that is a little different. And
13 I don't know if you want me to walk through the next
14 three slides because you've seen these before in the
15 previous version. There's not a lot new here, and there's
16 not a lot that's not, in fact, totally consistent with
17 what's in NUREG-1855. It just talks about, you know
18 -- well, let me not deal with it. Let me go on to the
19 next one.

20 In this case, what we're really saying is
21 that we've identified the owner of the PRA should have
22 identified the sources of model uncertainty because he
23 has to do that to meet the standard in the base PRA model.
24 There are other things that you have to do, though.
25 The things that are important are those that affect the

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1 risk metrics. So it's the uncertainties that can affect
2 the contributors to the risk metrics that are really
3 what we're trying to focus on here.

4 And they can come from two places. They can come from
5 the base PRA model, but they can also come from the way
6 that the cause/effect relationship is developed, from
7 the way that you model the impact. So you've got to
8 consider all these sources of uncertainty, and it's on
9 that set that can affect the risk metrics that we then
10 formulate sensitivity studies to see if they're going
11 to be significant. And the whole of the formulation
12 of the sensitivity studies and the logical combinations,
13 etcetera, is no different from what was in the previous
14 document and what's also in NUREG-1855.

15 And the next figure is, essentially, just
16 sorting out, using the sensitivity studies to sort out
17 which are the key sources of uncertainty. So we're really
18 looking for those that can impact the decision and, in
19 particular, those that can change the decision because
20 those are the ones that we need to focus on.

21 CHAIR STETKAR: Now, let me ask kind of a
22 question here. Does this whole process presume that
23 I have numbers for which I have no measure of uncertainty?

24 I don't want to call them parameters because of -- I
25 mean, in other words, why do I do sensitivity studies?

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1 Because I have no notion of what the real uncertainties
2 are?

3 MR. PARRY: No, no. Well, one thing you
4 can do sensitivity studies on, if you have a different
5 model to evaluate a specific parameter --

6 CHAIR STETKAR: That's true.

7 MR. PARRY: -- you can do a sensitivity study
8 on that. Now, there are other things you can do, though.
9 For example, human error probabilities that we know
10 we have no certainty on those --

11 CHAIR STETKAR: But we have quantified
12 uncertainties.

13 MR. PARRY: Yes, but do we really believe
14 that those quantified uncertainties are significant in
15 any way?

16 CHAIR STETKAR: You know, I'd argue that
17 if you don't believe that you're not doing what you ought
18 to do.

19 MR. PARRY: Well, I'm not --

20 CHAIR STETKAR: If you quantified your
21 uncertainties, you ought to live or die by them. They
22 mean as much as that seventh significant figure mean
23 value.

24 MR. PARRY: But in many cases, understand
25 that I think that a lot of the methods, the uncertainties

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1 are just, they're mandated, right? If the number is
2 X, then the error factor is three. If the number is
3 2X, maybe the error factor is five. There's no real
4 assessment of the uncertainty, if you'd like. It's almost
5 paying lip service to it. But what I'm saying is that
6 there are things you can do with HEP that one thing you
7 could say is, well, okay, let's see if I calculated all
8 the HEPs with model X I'll get one set of values and
9 I'd get their uncertainties. If I did them with model
10 Y, I'd get a different set. We realize this is, we meaning
11 I think a lot of people involved in the development of
12 the guidance documents, for example the guidance documents
13 for 5069, we realized back then it's pretty impractical
14 to get people to do two sets of HRA models to make any
15 sense.

16 So what you can do is you play with the values
17 as a set to see whether by increasing the human error
18 probabilities you're going to get different insights
19 than you would with a base and, similarly, if you lower
20 them you might get different insights. And I think it's
21 done, it's a slightly different sort of way of using
22 the sensitivity analysis. You're not using it to say
23 this is the result. You're using it to generate --

24 CHAIR STETKAR: You wouldn't do that with
25 pump failure rates, though or valve failure rates.

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1 MR. PARRY: No, probably wouldn't do that
2 with pump failure rates and valve failure rates because
3 I think we feel we have enough information on those
4 statistically to characterize the uncertainty, and that's
5 already addressed by using the mean values.

6 MS. PRESLEY: I think the key word on that
7 slide is the related assumptions. I mean, those are
8 really, the assumption, I mean . . .

9 MR. PARRY: Yes. Of course, the example
10 I gave is a little bit different because, in that case,
11 we're not really looking to calculate numbers, per se.
12 We're looking to characterize whether something is risk
13 significant or not. And the way it's done for 5069 is
14 you take the inclusive set, rather than the one particular
15 value of the HEPs. All right. We'll move on.

16 So in step six then, that's the part of the
17 integrated decision making. That's really where
18 everything comes together, and you're presenting the
19 results to the decision maker. So the topics that we
20 address in chapter five are comparison of the results
21 to the guidelines, a characterization of the results
22 to the decision-maker, and this includes, I think --
23 you can look there, John. I think it actually includes
24 the 50th and 95th percentile of the risk metrics, as
25 well as the mean value. So it's included in there.

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1 CHAIR STETKAR: It says parametric
2 uncertainty.

3 MR. PARRY: I'm sure it does, yes. It does
4 because I think the model uncertainties are going to
5 be characterized largely through the presentation of
6 the sensitivity cases for the various sources of model
7 uncertainty, and the reason we're doing it that way is
8 you can find out which of these sources of uncertainty
9 are going to help, are going to challenge the guidelines.
10 And given that, then you have to justify whether the
11 particular model uncertainty or the particular
12 sensitivity study that challenges the guidelines, you
13 have to first position it in some way, either by saying,
14 well, okay, this is not really credible but we put it
15 in there to see how bad it could get. That's one way,
16 okay? Another way is to say, well, okay, I'm not sure
17 about this, but I think if I put something in place,
18 like a compensatory measure, I can combat that source
19 of uncertainty. I can change the way I implement the
20 proposed change to effectively negate that source of
21 uncertainty. Oh, and the other thing is that, depending
22 on what that source of uncertainty is, I might be able
23 to do performance monitoring to make sure that the changes
24 that actually occur don't exceed a pre-defined level
25 that, well, that don't exceed a pre-defined level. And

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1 that really hasn't changed. I mean, that's always been
2 the case, I think, with all this stuff.

3 So the other things we address in that chapter
4 are, first of all, integration of the PRA results with
5 the other percentiles of risk-informed regulation, and
6 particularly defense-in-depth. We put something in on
7 defense-in-depth, and we put in a section on dealing
8 with large uncertainties, as well.

9 CHAIR STETKAR: Are you going to talk more
10 about those three things?

11 MR. PARRY: I'm not going to talk much about
12 the comparison of the results of the guidelines because
13 I think that's been covered pretty much elsewhere. I
14 will talk more about the, specifically about
15 defense-in-depth and a little bit about large
16 uncertainties.

17 So in this slide, it's just a recap of what
18 the five principles are and, clearly, where uncertainty
19 really rears its ugly head, if you'd like, where it's
20 dealt with is in two. It's also dealt with in three,
21 although we don't say very much about that. Safety margins
22 are clearly a way of dealing with uncertainty, but we
23 don't really deal with that one in this document. We'll
24 talk more about defense-in-depth. Really, the principle
25 thought is what we've been talking about anyway, and

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1 then the other one on the performance monitoring. I'm
2 not going to talk about that now, but that's also addressed
3 in there. And you know the classic example, again, of
4 that is 5069 where you're lessening the special
5 treatments. You don't really know how to model the impact
6 on equipment reliability, but if you set a limit such
7 that, if you set a limit on the increase of equipment
8 unreliability that is consistent with principle four,
9 proposed changes being small, if you do your performance
10 measurement to demonstrate that you can maintain it within
11 that value, then that's an approach to dealing with that
12 source of uncertainty.

13 Okay. Next one. So the proposed approach
14 that we've included in this report for addressing
15 defense-in-depth, I have to note that this is not something
16 that NRC has adopted or endorsed but we think it's a
17 fairly pragmatic approach. And I should say that,
18 although it's not written on this slide, I think one
19 of the assumptions going in here is that, given that
20 the plant has been designed and operated in accordance
21 with the regulations, it is assumed that the
22 defense-in-depth is, in fact, achieved to the extent
23 that we know about it. And Fukushima maybe throws a
24 little bit of a monkeywrench into that in some ways,
25 but that's, you know, that's something we can't do very

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1 much about. We're going to change the state of the plant
2 as it is. So to the extent that defense-in-depth is
3 adequate according to our state of knowledge at this
4 moment, we can assume that it's there.

5 So what we did was to develop a guidance
6 recognizing that defense-in-depth is essentially
7 hierarchical, by which I mean is that I think most of
8 the documents that you look at will accept, will agree
9 that defense-in-depth is established by having a set
10 of barriers, whether they're physical barriers or
11 administrative barriers. But there are things that you
12 need to have in place that prevent bad things from
13 happening. And the way that the plant achieves that
14 is by implementing certain strategies, like having
15 redundant or diverse systems, having training, all these
16 things that help to ensure that the barriers are, in
17 fact, effective.

18 So the focus of the approach that we've
19 presented in here is to make sure that, when the license
20 amendment request comes in, it doesn't affect the
21 presumed balance of levels of protection through physical
22 changes to the plant or changes to the way it operates.

23 And the -- if we can move on to the next one, I think.

24 So what we've done is to say that what they
25 should do is identify and assess changes that may adversely

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1 affect achieving a required safety function, particularly
2 when the level of redundancy or diversity is limited
3 or where significant uncertainty exists. Identify and
4 assess the impact of defense-in-depth crosscutting
5 changes, and these could be things like administrative
6 changes, maintenance changes, that will affect multiple
7 safety functions or cut across levels of protection.
8 And then we'll also use things that can't be addressed
9 directly by the PRA, such as late containment failures.

10 We don't really have a good metric for that in the current
11 regulatory framework.

12 CHAIR STETKAR: You mean in the current level
13 of PRAs that people have developed?

14 MR. PARRY: No, I mean in the current set
15 of metrics, like CDF and LERF, which are the ones that
16 we use for Reg Guide 1.174.

17 CHAIR STETKAR: Okay.

18 MR. PARRY: If we had acceptance guidelines
19 placed on large release or other things, then, yes, we
20 would have some way of looking at it. Okay. I should
21 actually say that if you look at SRP 19.2, which used
22 to be SRP Chapter 19 a long time back, a lot of these
23 thoughts are actually in there. I think the thing that
24 wasn't explicit in there was that the assumption that
25 the plant does start out with an adequate level of

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1 defense-in-depth. And I think that, in a sense, is what
2 makes this process logical. If you can't start with
3 that position, I think you're on a bit more shaky ground.

4 But what we concluded is that if you meet
5 the acceptance guidelines of principle four, you've
6 demonstrated to some extent, at least at an integral
7 level, defense-in-depth is maintained for those issues
8 that relate to CDF and LERF. You haven't changed them
9 very much. Therefore, you cannot change the
10 defense-in-depth very much. But that's really just an
11 overall look.

12 The thing that we're proposing is that what
13 you should do, though, is understand where the changes
14 are being made. And the example here is a, I think it's
15 quite a good one in the sense that it shows how this
16 can affect things differently.

17 So let's look at a couple of cut sets. They're
18 both low frequency, but one of them may also be low order.

19 If you look at, think about propose to change the
20 surveillance frequency on, say, the reactor pressure
21 vessel on the LPCS system for boiler, the pressure vessel
22 appears in a single element cut set. The LPCS appears
23 in cut sets of very high order typically because we have
24 so many systems in a boiler to put injection in. And,
25 also, if you look at the impact of the frequency of

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1 surveillance on the RPV failure probability and that
2 on the LPCS system, you probably have a lot more
3 uncertainty.

4 So while you could argue from the point of
5 view, perhaps, of a probabilistic argument that you could
6 justify a change for the reactor pressure vessel
7 surveillance frequency, you'd have to make a much stronger
8 case than you would for LPCS because for LPCS it probably
9 doesn't matter. You can probably take LPCS out of the
10 model and you wouldn't change the CDF very much at all.

11 CHAIR STETKAR: Risk achievement would be
12 pretty small.

13 MR. PARRY: Yes, yes. So this is just an
14 example, I think, of how you need to understand the role
15 of the thing that you're doing and relate it to the level
16 of redundancy, the role it plays in preventing, in
17 performing that function.

18 CHAIR STETKAR: Now, before you -- I'll ask
19 Mary. You had that nice qualifier on the bottom of page
20 20. It says this approach has not been endorsed by NRC.
21 Is that in the report?

22 MS. PRESLEY: It will be. That was one of
23 the comments, our comments.

24 CHAIR STETKAR: I was going -- since there's
25 a lot of discussion these days about defense-in-depth,

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1 one of the questions that I wrote to myself was, you
2 know, does the staff agree with this, regardless of my
3 own personal opinion.

4 MS. PRESLEY: That was one of the comments,
5 and we're going to add --

6 MR. PARRY: We're going to add a caveat.

7 CHAIR STETKAR: Okay.

8 MR. PARRY: Okay.

9 MS. DROUIN: We don't endorse it, but it's
10 not meant to say that there's not good thoughts or anything.

11 It's just a recognition, as you well know, that we have
12 ongoing work on defense-in-depth with, you know, going
13 forward with the development of the policy statement.

14 So that's all going to be worked out in the end, and
15 we're not going to get ahead on this EPRI document and
16 start endorsing things in a very narrow scope.

17 MR. PARRY: Yes. Because I think what you're
18 dealing with is a much bigger issue than this particular
19 case, which is to do with license amendment requests.

20 MS. DROUIN: I mean, and it will all trickle
21 down because, you know, we're in the midst of revising
22 Reg Guide 1.174, and that's been put on hold to after
23 the larger effort so that, you know, it's all done in
24 a consistent coherent manner.

25 MEMBER BLEY: What a concept.

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1 MS. DROUIN: I know. What a concept.

2 MR. PARRY: What is it? Consistency is the
3 hobgoblin of small minds. Is that what someone said?

4
5 MEMBER SHACK: Foolish consistency.

6 MR. PARRY: Oh, okay, thank you. Okay.
7 We've also got a discussion here on addressing large
8 uncertainties. This is really triggered by some of the
9 more recent events.

10 CHAIR STETKAR: Gareth, first, before we
11 go into this, how large does my uncertainty have to be
12 before it's large?

13 MR. PARRY: You know, I was pondering that
14 question when I was re-reading this section in preparation
15 for this meeting.

16 CHAIR STETKAR: No, I mean, seriously,
17 because it's sort of this section --

18 MR. PARRY: I know.

19 CHAIR STETKAR: -- you know, we're going
20 to talk about this section but --

21 MR. PARRY: Okay. I --

22 MEMBER BLEY: Your example comes to mind.

23 CHAIR STETKAR: Yes. And, indeed, that
24 uncertainty really wasn't all that large, like it wasn't
25 an error factor of a hundred. You know, it's not the

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1 kind of uncertainties that you see in seismic hazard
2 that are quantified. It was a fairly modest uncertainty
3 and, yet, without considering it, you would make the
4 wrong decision, for example. So I think it is important
5 to say you have this now section on ways to think about
6 and address large uncertainties.

7 MR. PARRY: Yes. I actually think, though,
8 what we've done is we've commingled a couple of things
9 in here because you could argue that a large uncertainty
10 is one that changes the decision perhaps. Okay. It's
11 large enough to worry about.

12 CHAIR STETKAR: Okay. But that certainly
13 doesn't come through here.

14 MR. PARRY: No, no, no, it doesn't. It
15 doesn't. And that wasn't the original intent of the
16 section.

17 MEMBER BLEY: You've hit on something kind
18 of interesting, though. Your example turned out
19 important. If you look at seismic, if you run median
20 values, you get the same kind of confusion. But if you
21 run mean values, usually you're okay. The uncertainty
22 there is so big, the mean is driven way up in the high
23 end of the distribution, which kind of makes it okay.
24 So if the uncertainty is large enough, mean values kind
25 of cover --

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1 CHAIR STETKAR: The 96th percentile anyway.

2

3 MR. PARRY: But I think what this was
4 triggered by was really things like external flooding
5 where we really do not have good models for calculating
6 the frequency of the events. And, therefore, you can
7 have very, very large differences between the frequencies,
8 particularly if you're trying to do any extrapolation
9 from the historical data, which may or may not be relevant.

10 But it also means that you don't necessarily have a
11 nice little distribution because what Dennis said is
12 true. If you've assumed a lot of normal distribution
13 or one of those skewed distributions, then, yes, the
14 mean gets driven way up as the uncertainty goes up, and
15 it will be ahead of the 99th percentile in some cases.

16 CHAIR STETKAR: Eventually, yes.

17 MR. PARRY: But in this case, maybe you don't
18 even have a distribution, you just have assessments that
19 are over a very large range. And what it really means
20 is that you really don't know what the frequency is.
21 It's not useful to do the standard Reg Guide 1.174
22 calculation because you don't know whether you've got
23 the mean.

24 CHAIR STETKAR: There is some, and this is
25 philosophy, and I don't, you know, we have to be careful

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1 about philosophy, but, see, my philosophy is you do know.

2 As a risk assessor, it is incumbent upon you to examine
3 all of the available information and express your current
4 state of knowledge with your uncertainty. That is the
5 best we can do. That is what we understand. We understand
6 that there's a five percent probability that I'll lose
7 40 percent of my net worth. That's really broad
8 uncertainty, but that's the best we can do today. And
9 we assess our risk and our margins to safety based on
10 our current state of knowledge, and if our state of
11 knowledge ignores the fact that we might have a 14 meter
12 tsunami hit my nuclear power plant sometime in my
13 measurable lifetime, you know, we've not done our job
14 right. If we'd evaluated our uncertainty for that and
15 said, yes, there's a measurable uncertainty that this
16 could happen, I still might make a decision that's wrong,
17 but at least you've done that.

18 So this notion that I can't evaluate the
19 frequency of large flooding because I can't evaluate
20 the uncertainty, I don't subscribe to that. Yes, you
21 can. It might be very broad, but if it's the best you
22 can do, if you've done a good job doing that, the best
23 you can do, that's what it is.

24 MS. PRESLEY: The question is is it, I mean,
25 how meaningful is it to do that if there are other things

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1 that you can do to get you a better understanding of
2 the situation? And that's where --

3 CHAIR STETKAR: What's a better
4 understanding, though? Give me an example of what's
5 a better understanding than that.

6 MS. PRESLEY: I think this idea of trying
7 to figure out if there are cliff edges. That's a good
8 -- I mean, the risk insights of what the large uncertainty,
9 where do you actually have to start worrying about it,
10 and then back-calculating, well, what would my frequencies
11 have to be and then what realm does that put me in?
12 Does that -- okay. The frequencies have to be slow that
13 that puts me in the realm of worrying about whether climate
14 change or not is driving my models, and maybe that's
15 where I can be a little bit more comfortable in saying
16 that. But if that cliff edge is driven by a different
17 type of model uncertainty, maybe the river shifts because
18 there's a seismic event or something, and that's more
19 graspable. Then maybe that changes our decision. I mean,
20 the numerics aren't important. It's the drivers behind
21 those numerics and trying to get at those when the
22 uncertainties are so long and everything is mushed into
23 a really broad distribution. You have to have some tools
24 to parse that out.

25 MR. PARRY: I tend to agree with Mary. At

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1 some point, the numbers do sort of become, I wouldn't
2 say necessarily irrelevant but they're certainly not
3 anything you can hang your hat on. Therefore, you should
4 be looking to other approaches to dealing with this,
5 and part of that is to understand what the impact of
6 these uncertainties is and is there anything you might
7 be able to do about it, or do you have to live with it?

8
9 But this would get into more -- this, though,
10 is also in, it's in the context of making risk-informed
11 changes to the plant, so the plant exists, as opposed
12 to changing the design of the plant to accommodate these
13 large uncertainties. And that's a definite thing, and
14 I think we have to be a little clearer about that in
15 the document.

16 CHAIR STETKAR: It might help.

17 MR. PARRY: Yes, because I think, you know,
18 we have to say, okay, there is a very large uncertainty.

19 We really don't know what's happening with the external.

20 But does, it might be --

21 CHAIR STETKAR: Let's say I wanted to install
22 FLEX stuff at my plant and want to know how high a pedestal
23 I need to put it on so it doesn't get washed away in
24 the flood that I'm trying to protect it against.

25 MR. PARRY: That's a design problem. That's

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1 a design problem.

2 CHAIR STETKAR: Well, should I need to know
3 how high that flood might be and how often --

4 MR. PARRY: I think it would be helpful.

5 CHAIR STETKAR: Okay.

6 MR. PARRY: But I --

7 CHAIR STETKAR: That's a change to my plant.
8 I mean, it's a relevant thing we're talking about.

9 MR. PARRY: Okay. It's a change to your
10 plant, but it's not -- yes. But that's a design change.

11 That wasn't what we were, it wasn't -- it's not going
12 to be -- okay, all right. Hold on, hold on. I've got
13 the answer. I've got the answer. That's a change the
14 plant was designed to make the plant safe for sure, right?

15 What we're talking about is changes to other things
16 in the plant and would they be affected by this particular
17 hazard event.

18 CHAIR STETKAR: One of the things, you know,
19 we can toss examples back and forth a lot, something
20 you said going in is that you might need to better define
21 the boundaries about what -- you said this is in the
22 context of a risk-informed change in the license.

23 MR. PARRY: Right.

24 CHAIR STETKAR: But my sense is it might
25 be a little bit more narrowly defined even than that.

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1 MR. PARRY: It's possible. Yes, I think
2 any change that you're going to make that can be
3 demonstrated to make the plant safer should be acceptable
4 without going through much --

5 CHAIR STETKAR: But, I mean, some of these
6 same principles could, as long as you're going to make
7 a change to make the plant safer, small changes that
8 have a large potential benefit, you ought to be aware
9 of that.

10 MR. PARRY: Yes.

11 CHAIR STETKAR: I mean, the fact, you know,
12 you put two meters of nominal grade versus three meters
13 above nominal grade, it might not be all that much expense
14 if you're making a change, given the fact that even two
15 meters will help you. Just something to think about.
16 It doesn't answer how big does it have to be before
17 it's big enough.

18 MR. PARRY: No, it doesn't. It doesn't.

19 MS. PRESLEY: But to address that, this
20 process is, and one of the public comments that we got
21 was that this process is fundamentally no different than
22 how you would assess any other model uncertainty with
23 one exception where you may not go that far in the
24 cliff-added effects, but, fundamentally, this is the
25 same --

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1 CHAIR STETKAR: Well, but even the cliff
2 edge effects, I'll come back to the 5 percent losing
3 40 percent of my net worth. I didn't lose it all.

4 MR. PARRY: You sound somewhat bitter about
5 that.

6 CHAIR STETKAR: That's why I'm somewhat
7 bitter. But even that, you know, it's uncertainty about
8 the degree of the hazard, the frequency and the
9 consequences. Go on. You know, we're going to run over
10 time here if we're not careful.

11 MR. PARRY: So, basically -- yes, we'll go
12 on to the next one. Yes. Basically, we just outlined
13 a process for doing this.

14 CHAIR STETKAR: Actually, back up to the
15 last one because there were a couple of things. I mean,
16 one is the philosophy of this whole thing, but, apparently,
17 flooding can't be addressed but seismic is no problem
18 because we know how to do that and have been doing it,
19 despite the fact that the uncertainty is not real big.

20 MR. PARRY: No, no, no, that's not, that's
21 also not taken out of the equation because there are
22 things in modeling that's seismic, and we give the example
23 of the correlation effect, for example, that can have
24 an impact, and that can be big because, basically, you're
25 saying you fail one and you fail them all. That can

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1 make a big difference to the frequencies.

2 CHAIR STETKAR: But in terms of the seismic
3 hazard, you feel pretty comfortable that we've expressed
4 our uncertainties in that okay, despite the fact that
5 they're really large. You have other examples about
6 --

7 MR. PARRY: Yes.

8 CHAIR STETKAR: -- doing sensitivities on
9 the mean of the seismic hazard, which you'll eventually
10 get to.

11 MR. PARRY: I think the thing with the seismic
12 hazard is we know the uncertainties are large, but we
13 also have, to some degree, a consensus approach to
14 calculating those. So it's a frequency, but there's
15 a consensus approach to representing the uncertainty.

16 CHAIR STETKAR: So if we had that consensus
17 approach for flooding, we'd be okay with flooding.

18 MR. PARRY: We'd be in better shape.

19 CHAIR STETKAR: Okay.

20 MR. PARRY: Right.

21 CHAIR STETKAR: Okay.

22 MR. PARRY: Okay. So the process is really,
23 it's not very different from what you would do. You
24 would understand if this source of uncertainty, what
25 is its role in the decision making, how does it affect

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1 things, and then we have some ideas on how you address
2 that and how you might integrate it with the other
3 principles but particularly defense-in-depth.
4 Performance monitoring for some things really is not
5 going to help you too much. You can't monitor the impact
6 of a large flood, for example. If it happens, it happens.

7 So the types of things that we do is, in
8 recognizing that the large uncertainties, one of the
9 things they can do is they can potentially overestimate
10 computed risk. In some cases, that overestimation is
11 known to exist. In some cases, it's not known whether
12 it's an overestimation or not. It depends on the type
13 of uncertainty we're talking about.

14 One of the things that's critical is that,
15 if you put conservative assumptions into a model, and
16 one of the examples is this complete correlation of seismic
17 failures, you can mask the effect of the change on the
18 risk because you could take a diesel out for maintenance.

19 If you assume that when the earthquake hits that all
20 the diesels fail, then it has no impact on the risk by
21 taking that out. It's a rather extreme example, but
22 it's a case of where making a conservative assumption
23 can mask the change in risk. But you can see whether
24 that's significant by relaxing that particular assumption
25 in that case, so maybe you don't put the correlation

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1 in and you put it in as random and see whether that changes
2 things. So that's one way of looking at it.

3 CHAIR STETKAR: Some of that, though, there
4 is guidance in NUREG, and I can't recall --

5 MR. PARRY: Yes, I think there probably is.

6 CHAIR STETKAR: -- about subdividing
7 contributors by hazard groups. So, for example, if you
8 looked at, you wouldn't see a change in your example
9 for the seismic hazard group, but you might see a measurable
10 change for the internal events hazard group. That's
11 a different set of -- and when you combine the two, if
12 your risk was dominated by seismic, that's a third piece
13 of information. But the decision-maker would have that
14 comparative information.

15 MR. PARRY: Yes. And we --

16 CHAIR STETKAR: You're saying prompt the
17 computer about the whole listed pie.

18 MR. PARRY: Well, not necessarily because
19 this would be a portion of that pie that could mask
20 everything by --

21 CHAIR STETKAR: Sure, sure.

22 MR. PARRY: So I don't think it's any
23 different. I think you always have to understand where
24 this -- that would come into understanding the role in
25 the decision making and the potential to affect the

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1 decision. So I think, yes, no, a part of what we describe
2 in this report is, in fact, that you do have to decompose
3 the results and understand where they come from.
4 Potentially underestimating the computed risk, while
5 I'm not quite sure what -- to be honest, I can't remember
6 what we were thinking about here. But if you've got
7 large uncertainties, the certainty is the possibility
8 that you can underestimate risk. But it escapes my mind
9 now what we precisely had in mind with that.

10 But as far as the cliff edge goes, one of
11 the ways you can look at it, at least in the decision
12 making context, is say, you know, reverse engineering,
13 if you'd like, figure out what likelihood for this cliff
14 edge would you have to have to make it significant to
15 the decision and then work on that basis.

16 CHAIR STETKAR: Okay. Let's think about
17 that because Mary brought it up. Let's think about the
18 floods and say, okay, I need to have a 14-meter flood
19 to come over my cliff edge effect. How do you address
20 that? What is the likelihood that you would get that
21 and how you divine a likelihood that gives you confidence
22 that you can make a decision that it's not a problem?

23 MR. PARRY: I think what you'd have to do
24 is you'd say, okay, I'm going to say I've got my decision,
25 this is an element in the decision, how high does that

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1 frequency, and let's say the consequences of this cliff
2 edge is that you have core damage. CCDP is one. What
3 you would be looking at to see is at what frequency is
4 that assumption likely to change my decision, if it can?

5
6 CHAIR STETKAR: Okay.

7 MR. PARRY: That gives you a piece of
8 information. What you do with that information, it's
9 like any of the other assumptions that we're going to
10 deal with because none of these assumptions can be proved.

11 So you have to come up with an argument of why you think
12 that frequency is low enough that you can live with it.

13 And that may be a specialist argument. I mean, we can't
14 give the guidance on how you do that, but that gives
15 you a path for at least trying to address that situation.

16 But it's like any other assumption. If we have two
17 assumptions, and one of them kills the decision and the
18 other one doesn't, you still have to make, if you want
19 to go with the decision, you still have to explain why
20 that assumption that kills it is not believable.

21 CHAIR STETKAR: Have some confidence that
22 the frequency is low enough that --

23 MR. PARRY: Not the frequencies because this
24 isn't the frequency. This is is this assumption correct
25 or is that assumption correct. You have to have confidence

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1 that that assumption is not a credible assumption.

2 CHAIR STETKAR: I think I lost you. Walk
3 me through the example of the cliff edge effect on the
4 flood because I lost something about an assumption.
5 There is a flood high enough that's going to flood the
6 whole thing.

7 MR. PARRY: There is, and you know what it
8 is.

9 CHAIR STETKAR: And you know what it is
10 because you know what elevation --

11 MR. PARRY: Because you've calculated the
12 elevations. What this is saying is, okay, I want to
13 do -- what I need to know is what is the likelihood that
14 that cliff edge occurs that could change my decision?
15 If that likelihood was a 10 to the minus 2, I'd say
16 I've got a problem.

17 CHAIR STETKAR: Well, when you say
18 likelihood, I think frequency, so maybe we're not
19 communicating.

20 MR. PARRY: It's the frequency of the flood
21 that --

22 CHAIR STETKAR: That is big enough.

23 MR. PARRY: -- is big enough to give you
24 the cliff edge, right.

25 CHAIR STETKAR: Okay. So we're talking

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1 about the same notion --

2 MR. PARRY: Yes, we are.

3 CHAIR STETKAR: Okay.

4 MR. PARRY: Okay. So all the reverse
5 engineering does is it tells you what that frequency
6 has to be to change the decision. Now what you have
7 to do is you have to look at all the evidence to decide
8 whether that frequency is believable.

9 CHAIR STETKAR: So you have to assess your
10 confidence in --

11 MR. PARRY: You have to do some assessment,
12 yes. And I think it's a little different from producing
13 a hazard effect because now you can start piling on extreme
14 things to come up with it to see whether you can get
15 that frequency.

16 CHAIR STETKAR: So I don't see a difference
17 in the two processes --

18 MEMBER BLEY: That's where I'm kind of
19 sitting here and --

20 CHAIR STETKAR: There's some subtlety here
21 that I think I'm missing but . . .

22 MR. PARRY: Well, I think that's because
23 you guys come from the Caplan school of putting
24 probabilities on everything, right?

25 CHAIR STETKAR: Well, because there probably

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1 is probabilities on everything. Sometimes they're really
2 small, and sometimes the range is fairly large.

3 MR. PARRY: I'm being a little facetious,
4 but I think there is a difference with trying to make
5 a case that a likelihood that you've come up with is
6 bounding or not likely to be achieved than there is to
7 try and do an analysis that gives you a whole range of
8 frequencies because you can look it from a more bounding
9 approach this way. And if you can show that you think
10 that likelihood, that frequency is, the way you'd have
11 to get to that --

12 CHAIR STETKAR: I mean, I see what you're
13 saying, honestly, Gareth. But I'll take your 10 to the
14 minus 2 number. If I say there's a half of one percent
15 probability, 0.005 probability that, indeed, the
16 frequency would be 10 to the minus 2, is that good enough?
17 I mean, is that sufficiently incredible, or does it
18 have to be a one billionth of one percent probability
19 that it could be that high?

20 MR. PARRY: Well, I don't see how --

21 CHAIR STETKAR: For a decision-maker. Now,
22 this is a decision-maker because a decision-maker is
23 going to make a decision, you know. And depending on
24 how risk adverse that decision-maker is, a half of one
25 percent might be good enough or a one billionth of one

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1 percent might not be good enough, depending on the
2 particular decision-maker.

3 MR. PARRY: No, I don't think we can do that.

4 I also don't think that I, I mean, this is what I meant
5 by saying you were following the Caplan school of thought
6 that you can actually put a probability on that. I'm
7 not sure you can because I don't know how you would do
8 it, to be honest. So I'm not even suggesting you can
9 come up with these numbers, like I am, you know, 0.02
10 percent confidence that this is bounding. To me, that
11 doesn't mean --

12 CHAIR STETKAR: Well, but if I'm a
13 decision-maker and you say, well, look, the frequency,
14 to make a difference, the frequency has to be whatever,
15 10 to the minus 2, once in a hundred years. If it's
16 less than that, it isn't going to make any difference.

17 MR. PARRY: Right.

18 CHAIR STETKAR: If it's more than that, I've
19 got a real problem. How do you convince me that, indeed,
20 I am so confident that I'm not even close to that 10
21 to the minus 2 that I don't need to worry about it?
22 How do you develop that convincing argument? Do you
23 just say, well, obviously, these things are incredible?

24
25 MS. PRESLEY: So if you have a --

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1 CHAIR STETKAR: You know, it's much less
2 than the frequency of a meteorite hitting the plant that,
3 that --

4 MEMBER BLEY: The decision-maker is going
5 to say how sure are you of that.

6 CHAIR STETKAR: How sure are you of that.

7 MR. PARRY: I agree. And I think maybe the
8 things you have to do to look at all the things that
9 could happen, that would have to happen to generate that
10 and come up with some frequency, but I'm guessing here
11 because I'm not an expert in hydrology, right? So I
12 can't tell you how to do that. All I'm saying is that
13 this is one way of looking at it, and then somebody would
14 have to come up with the argument that this frequency
15 is believed to be negligent. And I think it's not that
16 we're saying it's, I wouldn't want to say it's 0.02 percent
17 because the decision-maker wouldn't know what to do with
18 that anyway. These decision-makers are not, they're
19 not sitting there with a, you know, calculator saying
20 --

21 MEMBER BLEY: But, see, you were real close,
22 you were real close to the non-quantified way is when
23 you can say I've considered this list of all the things
24 that could contribute and I can't think of anything else
25 and I can't find anything in the literature beyond this

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1 set, this is a complete set. Then you're pretty far
2 along in the game, whether you do what John wants or
3 not.

4 MS. PRESLEY: Or if you can winnow it down
5 to a couple of things that are so uncertain and so little
6 data is available. I mean --

7 MEMBER BLEY: Then I'm going to want to hire
8 a wall.

9 MS. PRESLEY: Then you're going to -- yes.
10 But at least that tells you something.

11 MEMBER BLEY: Or bigger pumps inside or
12 something.

13 MR. PARRY: No, we're not claiming that we
14 have all the answers to this. We've --

15 CHAIR STETKAR: I mean, it's help. I
16 understand, you know, sort of the rational that you're
17 using and the approach. I'm not convinced personally
18 that the amount of effort is different, whether you
19 approach it from building to hazard or whether you look
20 at how big does the hazard have to be to give me confidence,
21 but I at least understand.

22 MR. PARRY: And perhaps what we need to do
23 is to maybe have some examples of how this is done and
24 try to --

25 CHAIR STETKAR: You know, examples really

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1 help.

2 MR. PARRY: Yes.

3 CHAIR STETKAR: But go on.

4 MR. PARRY: So, really, that's all I think
5 we wanted to say about this particular issue. I mean,
6 if you have specific comments, obviously we'd like to
7 hear them. But just on the next slide --

8 CHAIR STETKAR: The only comments I had
9 reading through this, and I actually thought that this
10 discussion of large uncertainties, I liked it.

11 MR. PARRY: Okay, good.

12 CHAIR STETKAR: I really did. Some of the
13 specifics I didn't like so much.

14 MR. PARRY: Yes.

15 CHAIR STETKAR: This whole notion of when
16 you say that you can do an uncertainty, a sensitivity
17 study on the mean unreliability value, and there's several
18 statements. And when you talk about sensitivity studies,
19 you talk about them in terms of sensitivity studies on
20 the mean unreliability values for operator reliability,
21 organizational effectiveness. There's several things
22 where you talk about that phrase. As soon as I --

23 MR. PARRY: In chapter five?

24 CHAIR STETKAR: Table 5-1.

25 MR. PARRY: Okay, okay.

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1 CHAIR STETKAR: Okay. As soon as you say
2 mean value, I think I already have an uncertainty
3 distribution because I have a mean value. And once I
4 have an uncertainty distribution doing a sensitivity
5 study doesn't make any sense to me because I already
6 have all of the information I need.

7 MR. PARRY: Okay.

8 CHAIR STETKAR: That's why I asked earlier,
9 if I have a guess, I guessed it was 10 to the minus 3
10 without doing any real analysis, then, yes, doing a
11 sensitivity study on what happens if it's 10 to the minus
12 2, what happens if it's 10 to the minus 1, in some sense,
13 makes some sense.

14 MR. PARRY: Yes, okay.

15 CHAIR STETKAR: Because people will look
16 at that and say, well, okay, I have a mean value, I have
17 a mean frequency of a seismic acceleration of one g.
18 I had that mean value, and if I vary it plus or minus
19 five that's okay. Well, I have the uncertainty
20 distribution. Just use it.

21 MR. PARRY: Your point is taken. I think
22 we need to look at that to make sure that we're not using
23 the terms inappropriately, using the term "mean"
24 inappropriately because I don't think that's what we
25 meant. Yes, you're right. If you have a distribution,

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1 why --

2 CHAIR STETKAR: Why not use it?

3 MR. PARRY: -- sensitivity. Yes, I agree.

4 So I think we just need to --

5 CHAIR STETKAR: This notion of where you
6 do -- that's a lot of what I hung up on this because
7 it might be just misinterpretation of terminology or
8 something. In many cases, I got the notion that you're
9 recommending that we do sensitivity studies on things
10 for which we already have some quantitative estimate
11 of the uncertainty. And as I said, when I read mean
12 value, that's what I think.

13 MR. PARRY: I think in some of the literature
14 related to this in the past, that is, in fact, what's
15 done, like with common cause failures, right? Some of
16 the common cause failure things are all shifted to the
17 95th percentile just to see if it makes any difference
18 because, actually, if you -- but that's in the case of
19 looking for insights as to what's significant, as opposed
20 --

21 CHAIR STETKAR: Yes. But, I mean, people
22 have criticized that approach also --

23 MR. PARRY: I know they've criticized that
24 approach, but, you know, you need to do something because
25 the impact there is that if you overload the common cause

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1 failure stuff, you're going to mask stuff.

2 CHAIR STETKAR: Sure.

3 MR. PARRY: If you under-load it --

4 CHAIR STETKAR: Sure. But, see, the point
5 is if you've done a decent job of evaluating the available
6 data and assessing your uncertainty about that, saying
7 how bad could it be if your beta factor was one, I mean,
8 it doesn't make any sense. Make it seven.

9 MR. PARRY: That would be interesting.

10 CHAIR STETKAR: Do you follow what I'm
11 saying?

12 MR. PARRY: Oh, yes --

13 CHAIR STETKAR: Some of that notion of just
14 doing sensitivity studies for the notion of kind of playing
15 numbers games is not what we ought to be telling people
16 to do.

17 MR. PARRY: No, except what you're really
18 doing is you're saying, well, okay, what happened, I'm
19 going to look, I know that my common cause failure
20 methodology isn't that great and the data is pretty sparse.

21 What happens if we were way off on CCF either one way
22 or the other? Does it change the way, does it change
23 the way the risk profile looks sufficiently to give me
24 different insights? And it's done for that reason alone.

25 It's not --

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1 CHAIR STETKAR: But if we were way off, the
2 data would have told us that. We would have seen either
3 no common cause failures or we'd be seeing them everyday.

4 MR. PARRY: But you know that the way that
5 the common cause failure database is. There's an awful
6 lot of judgment that goes into calculating those numbers.

7 CHAIR STETKAR: You know, but there's a
8 judgment -- if this valve failed, is it a failure or
9 not?

10 MR. PARRY: Yes, I know, I know, I know.

11 CHAIR STETKAR: So there's uncertainty in
12 everything that we do.

13 MR. PARRY: Right.

14 CHAIR STETKAR: Go on. We're getting short
15 on time.

16 MR. PARRY: Yes. This is just a reminder.
17 This is just a summary of what's in chapter three, and
18 that's just some explanation of how you might decompose
19 results to get an understanding. That's the intent of
20 it. It's a bit of an orphan in this presentation, but
21 I just put it in there. I don't think there's too much
22 controversial about that, hopefully. That's all I wanted
23 to say. Well, I mean, again, it's not changed from what
24 was in chapter seven of the old NUREG-1855.

25 MS. PRESLEY: So then the last piece is,

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1 obviously, we have the appendix, the appendices.
2 Appendix A illustrates how we applied our process. B,
3 C, D, E provide tables. There's an excerpt of the headings
4 for the tables for fire, seismic, low-power shutdown,
5 and Level 2.

6 CHAIR STETKAR: Let me ask you about Appendix
7 A. The NUREG report solved many of our questions back
8 in June about the example by excising the example from
9 the NUREG report. So the NUREG solved all of our issues
10 regarding the example in the NUREG. The example, I did
11 a text compare side by side and, other than references
12 to specific section numbers, it's verbatim from what
13 the example was in the NUREG.

14 MS. PRESLEY: I thought we put in a couple
15 more caveats.

16 MR. PARRY: I thought there were a few more
17 caveats put in --

18 CHAIR STETKAR: Well, not in the text compare
19 I did, and I looked at the June version of the NUREG
20 and I looked at the version of the example in at least
21 the incarnation of your report that we got, the one that
22 went out, I guess, for public comments you said. And
23 I challenge you to find differences. Certainly --

24 MS. PRESLEY: It would have been in
25 footnotes, but they were there.

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1 CHAIR STETKAR: I think I even checked the
2 footnotes.

3 MS. PRESLEY: Okay.

4 MS. DROUIN: I can tell you that, and maybe
5 it's in an earlier version, and this was before you were
6 on the committee, when the committee first saw it --

7 MEMBER BLEY: I think John was here when
8 we first saw it. I don't know.

9 MS. DROUIN: I don't think he was.

10 MS. PRESLEY: Well, we definitely discussed
11 the changes. Whether or not those changes made it in
12 the August draft, I'll have to double check.

13 CHAIR STETKAR: All I'm doing -- okay. I
14 don't care when I joined the committee.

15 MS. DROUIN: I just don't know if we're
16 talking about the same changes.

17 CHAIR STETKAR: I compared -- here's what
18 I did. I took the version of NUREG-1855 Rev 1 that we
19 reviewed in June of this year that had the appendix in
20 it. I compared that text side by side with Appendix
21 A in the version of the EPRI report that we received
22 for this meeting. Now --

23 MS. DROUIN: Okay. You would not have seen
24 changes between those two.

25 CHAIR STETKAR: Boy, oh, boy, I'm glad to

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1 hear that because I didn't. So there's a newer version
2 of the EPRI report that we haven't seen?

3 MS. DROUIN: No, no, there's obviously a
4 miscommunication of changes that you wanted to see that
5 we have not done.

6 CHAIR STETKAR: Yes. I mean, that was my
7 -- okay.

8 MS. DROUIN: And I think that's where there's
9 a disconnect because, if we go back a couple of years,
10 the criticism that we had gotten on the appendix is that
11 we didn't have enough caveats and that it could be misused.

12 And I know that we systematically went through and added
13 those caveats. That would have been over the version
14 you saw. So I guess what I'm not understanding is what
15 are the things you were looking for that we haven't done?

16
17 MR. LAI: You're talking about 209 of the
18 NUREG, Rev 0?

19 MS. DROUIN: I think that's what it was is
20 that we really had not done something that you're looking
21 for because I can tell you the differences between the
22 two, there really, except perhaps in tweaks that they
23 did in moving it into their document, there weren't
24 full-scale changes made.

25 MS. PRESLEY: No, there were a couple. I

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1 do remember there were a couple of comments from John,
2 actually, I think most of them came from John from the
3 last meeting, and they were, I think the flooding, the
4 way we positioned the flooding or the seismic, one of
5 those --

6 CHAIR STETKAR: I have my notes here, and
7 it's because we're running long --

8 MS. PRESLEY: We definitely discussed them.
9 I --

10 CHAIR STETKAR: The concern I had is the
11 notes I had written to myself after the last discussion
12 is that my sense was that, I mean, the notes says, yes,
13 the staff is going to look into this, the implication
14 being that something might be --

15 MS. PRESLEY: Yes, yes, they did change.

16 CHAIR STETKAR: -- changed.

17 MS. PRESLEY: We have the changes. I'm not
18 sure, like, for instance, in Table A-3, the note at the
19 bottom has changed. In the June version that went to
20 you for the last meeting, the note said analysis supporting
21 these conclusions would typically be --

22 CHAIR STETKAR: That one, that one did --
23 you're right. Yes, that footnote did, indeed, change.
24 That one I stand corrected. I was wrong. That one did
25 change, that one footnote about other -- I've forgotten

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1 what it is, but it's the one you cited. I was talking
2 more about details of the examples itself, themselves,
3 that we had some comments on in June --

4 MS. PRESLEY: Yes, I think we ended up adding
5 just a couple more caveats instead of changing the examples
6 because we didn't have the resources at that time. Are
7 there specific ones that really give you heartache that
8 we should really need to go back and look at?

9 CHAIR STETKAR: You know, it's because of
10 time -- I'd go back to our comments from the June meeting.

11 The ones -- what I don't like to do here is, I had raised
12 some questions in June about specific items. I've got
13 15 pages of things, but it's not fair to raise new ones
14 at this point that I didn't raise in June. I had my
15 shot back in June. In the interest of time, though,
16 it's not clear to me that that's the most effective use
17 of our time today --

18 MS. PRESLEY: Okay. Well, if --

19 CHAIR STETKAR: -- because I still have about
20 a half a dozen things that I raised in June that weren't
21 changed.

22 MS. PRESLEY: Okay.

23 CHAIR STETKAR: It's not our report.

24 MS. PRESLEY: Well, I mean, we can take a
25 look through the -- I know some of those comments are

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1 intermingled with other comments on examples that were
2 in 1855 because that's when those discussions came up.

3 You were talking about examples generally and the use
4 of examples in the document, and you bounced back and
5 forth between stuff that was in Appendix A and stuff
6 that was elsewhere. So we could have very well missed
7 some of those comments. We can take a look back at the
8 notes from the last meeting and try to do a scrub, unless
9 you'd like to send --

10 CHAIR STETKAR: A lot of the comments in
11 the examples, quite honestly, are not, they're items
12 that would benefit, in my mind, from more caveats or
13 better elaboration because I still believe that someone
14 will pick up this document and use it as a template for
15 the bare minimum that needs to be done to check off the
16 box that I've satisfied things. And, therefore, what's
17 in the example is, in many cases, okay within the context
18 of that particular example. What's not in the example
19 might be inferred as something I don't need to do.

20
21 MS. PRESLEY: Right. And other than dealing
22 with that in the introduction to the appendices, I mean,
23 when we footnoted that caveat a couple of places, I mean,
24 you can caveat until you're blue in the face. I don't
25 know how much is useful. So if there's, again, some

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1 specific parts, I'll go back and look at the notes, if
2 there's some specific things that you think will lead
3 people down a rabbit hole, I think it's important to
4 caveat those. But I'm wary of caveating everything
5 because we do have the general caveat up-front. That's
6 a lot of use of the word caveat.

7 MS. DROUIN: Well, you need to balance it
8 because you don't want to give so many caveats that you
9 discount the whole piece of work there.

10 CHAIR STETKAR: See, part of the thing is
11 one approach is to have very, very detailed examples,
12 which you run the risk of people focusing on that as
13 saying this is necessary and sufficient to achieve.
14 The other is to have perhaps less detailed examples but
15 more that will say, hey, here's an example of something
16 you ought to think about and a real practical example.

17 So rather than going through -- what this is is a detailed
18 evaluation of a particular, very-focused change and saying
19 this is the right way to do it. The other approach is
20 to highlight things, you know, like my fire example of,
21 hey, here's something that has a practical implication.

22 It's not a nuts to soup, beginning to end -- no, nuts
23 to soup is, indeed, beginning to end because you start
24 with things and you grind them up and make a roux and
25 create a soup -- beginning to end template for how to

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1 do an analysis. It's rather other examples to say, well,
2 here's an issue and here's one way to address it and
3 here's a different issue and here's an example of another
4 way to address it. So it's broader this way rather than
5 deep this way.

6 MS. PRESLEY: Right. And I think this
7 appendix specifically we were trying to get the deep
8 to show --

9 CHAIR STETKAR: Absolutely.

10 MS. PRESLEY: -- the process.

11 CHAIR STETKAR: That's what it does.

12 MS. PRESLEY: And we'll put the broad where
13 they're needed. I just wanted to point out the caveat,
14 and I think we added or at least tweaked this sentence
15 in the introduction. It should not be construed to imply
16 that this is the only approach or that the specifics
17 of the illustrative example would be sufficient in all
18 cases.

19 CHAIR STETKAR: No, that's -- and I think
20 that was in the old one, also.

21 MS. PRESLEY: Oh, okay.

22 CHAIR STETKAR: But then, again, somebody
23 is going to read that and --

24 MS. PRESLEY: No, we understand but --

25 CHAIR STETKAR: You can't make it perfect.

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1 MR. PARRY: Right.

2 MS. PRESLEY: The other reason it's in the
3 EPRI document and not the NUREG.

4 CHAIR STETKAR: I just, a lot of the detailed
5 examples I brought up in June were meant to sort of
6 illustrate this point. And whether you want to address
7 it by caveats -- I don't know the best way to address
8 it, quite honestly. But it comes back to kind of reading
9 the document with a very cynical skeptical approach to
10 how someone might construe it as being the absolute minimum
11 necessary and sufficient to satisfy the perceived
12 regulatory requirement. I mean, the last thing I think
13 anybody wants to have done is somebody follow, perhaps
14 naively, the guidance in this, come in with an application,
15 and have the staff say, well, this isn't adequate.

16 MEMBER BLEY: Well, that might not be the
17 last thing we'd want to see but . . .

18 MS. PRESLEY: No, that's a training issue.

19 MEMBER BLEY: One thing we haven't talked
20 about are the Tables B, C, D, and E. And I don't know
21 if you're going to -- you don't have another slide?

22 MS. PRESLEY: No, this is it.

23 MR. PARRY: No, we didn't intend to go through

24 --

25 MEMBER BLEY: There's a lot of stuff in those

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1 tables. Now, John's analyst who he's so worried about
2 won't look at those, but, if I'm going to look at those,
3 this sure gives me a lot of hints about things to think
4 about.

5 MS. PRESLEY: John's analyst should look
6 at that. This is the --

7 MR. PARRY: Well, no, that's the intent of
8 having them in there, though, is that they look at them.

9 MEMBER BLEY: Okay. But you can't cookbook
10 these things. These aren't cookbooks.

11 MR. PARRY: No, no, you can't.

12 MEMBER BLEY: This is a pretty broad set
13 of --

14 CHAIR STETKAR: It is.

15 MEMBER BLEY: -- ideas. They're more ideas.

16 CHAIR STETKAR: It is. And, see, I see those
17 tables useful --

18 MEMBER BLEY: I like that.

19 CHAIR STETKAR: -- more useful than the
20 specific detailed example.

21 MEMBER BLEY: Well, you can't, I mean, are
22 you recommending that we get rid of all the examples?
23 I don't think so.

24 CHAIR STETKAR: No, no, not those tables.

25 MEMBER BLEY: No, no --

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1 CHAIR STETKAR: Appendix A.

2 MS. DROUIN: There is two different
3 purposes, and 1855, in numerous places, sends the licensee
4 to those appendices, saying, okay, go to EPRI document,
5 you know, appendix blah, blah, blah, for a generic list
6 of model uncertainties that you need to consider.

7 MEMBER BLEY: Consider. And that's a whole
8 set of information we haven't been talking about all
9 day.

10 CHAIR STETKAR: No, that's absolutely true.

11 MEMBER BLEY: And I guess I'm, I don't know
12 what corner I get backed into listening to my colleague
13 here, but we can't have enough detailed examples in
14 Appendix A to cover everything. But having some is pretty
15 darn useful to help people deal with it. Maybe one wants
16 a warning on every page don't cookbook this, go see the
17 other tables, you know. There's a lot of issues to be
18 considered, but I think that's a really useful set of
19 information.

20 I haven't quite completely come to grips
21 with how not the person I'd like to see doing these analyses
22 but the person who's coming at it kind of cold, how they
23 learn to use those. That's a bit of a trick. What I
24 haven't thought about before is do our examples in Appendix
25 A send us back to those for ideas?

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1 CHAIR STETKAR: No, no, no, that's the
2 problem. That's the problem.

3 MEMBER BLEY: And I think that could be a
4 useful thing.

5 MS. PRESLEY: Yes. So that was one of the
6 public comments that we got, actually, from the user
7 review is you haven't used the tables that you gave us
8 in your appendix. And it was because that example was
9 developed, obviously, way, way before those tables
10 existed.

11 MEMBER BLEY: Maybe John was daisy-chaining
12 toward this all day.

13 MS. PRESLEY: But that's one of the revisions
14 that we're going to make in Appendix A. We're either
15 going to find a way to incorporate them or put in that
16 this was developed before those. Ideally, you would
17 use --

18 MS. DROUIN: That's not an accurate
19 statement.

20 MEMBER BLEY: Which one?

21 MS. DROUIN: That it doesn't use the tables.
22 Remember these are the new tables. There's also the
23 tables in the other EPRI report on internal events,
24 internal flood, and it does refer back to those because,
25 at the time, this example is just meant to illustrate

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1 the process. So it does look at how to use these generic
2 sources. It's just for internal events as the example
3 it uses.

4 CHAIR STETKAR: What I wanted to ask is,
5 and that's absolutely true, Mary, but what I wanted to
6 ask is you got comments from the public on EPRI 1026511
7 --

8 MS. PRESLEY: Yes.

9 CHAIR STETKAR: -- that report that has these
10 appendices in it. Now, the RHR example in Appendix A
11 of this report used to live as Appendix A of the NUREG.
12 In EPRI 1016737, there were the companion tables for
13 internal events and flooding that listed these similar
14 types of things, but it didn't have the example. Did
15 you get any comments -- I mean, you don't -- the example
16 that used to live in the NUREG that is now Appendix A
17 of this report doesn't very well talk to Appendices B,
18 C, D, and E. I don't recall, honestly, whether the example
19 in Appendix A of this report talks very well to what
20 are the companion tables in that other report. Follow
21 me?

22 MR. PARRY: I think it does. I think it
23 does.

24 CHAIR STETKAR: Does it? I don't recall
25 that.

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1 MR. PARRY: Well, that's the way it was
2 developed because, in fact, both that table and the example
3 were developed at the same meeting so --

4 MEMBER BLEY: Let me ask you a question.
5 Once all this comes out and it's published, is EPRI planning
6 some courses on use of this?

7 MS. PRESLEY: Not specifically now, unless
8 there's a need for it. We're kind of --

9 MEMBER BLEY: I'm telling you there's a need
10 for it if anybody is going to use it. You have courses
11 on a lot of other things.

12 MS. PRESLEY: We do.

13 MEMBER BLEY: This isn't the easiest thing
14 to go do if you haven't, if you're not with a group.
15 You know, those of us who have done a lot of this, we've
16 been in a group where there's a bunch of people working
17 on it and you trade ideas and work it out. So if you're
18 the person doing the uncertainty analysis, you don't
19 have that. It's real hard to learn to do this stuff
20 strictly from a report.

21 MS. PRESLEY: We can certainly approach our
22 users and see if they would like the training.

23 MEMBER BLEY: Or maybe your consultants are
24 already planning such a course.

25 MS. PRESLEY: Or maybe it's already -- I

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1 don't know. But training is definitely a component of
2 how guidance is used.

3 MEMBER BLEY: NRC will probably have its
4 own course, I assume.

5 MS. DROUIN: On this document?

6 MEMBER BLEY: Or work it into the PRA course
7 or something like that.

8 MS. DROUIN: There are no plans for right
9 now.

10 MS. PRESLEY: Not currently, but we haven't
11 thought that far ahead, frankly. And it's not that we're
12 opposed to it either. So we can bring that up --

13 MEMBER BLEY: It's worth thinking about.

14 MS. PRESLEY: Yes.

15 MEMBER BLEY: Because it's --

16 MS. PRESLEY: I think, particularly, because
17 I don't think in this go-around we're going to have the
18 time or necessarily the ability to explicitly link
19 Appendix A example to the tables and the uncertainty
20 in those tables. I think what we're going to do is give
21 a more general statement about how it needs to be done
22 and maybe, if we have thoughts on how it could be done,
23 put that in. But if we did do training --

24 MEMBER BLEY: I think that seems reasonable
25 at this point.

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1 MS. PRESLEY: Yes. If we did do training,
2 maybe that's something we could look at is actually,
3 well, no kidding, how do you really use these tables?

4 MR. PARRY: I think the other aspect to put
5 in here is that one of the big contributors here would
6 be fire, right? That's the one we'd have to think about.

7 MS. PRESLEY: And that's the one that the
8 public comment was --

9 MR. PARRY: Yes. And that's pretty fluid
10 right now --

11 CHAIR STETKAR: Well, and some of the
12 comments, some of the comments that we'd had -- I don't
13 think it got into our letter. I don't remember, John.

14 On 1934, the fire modeling, NUREG, was that the staff
15 ought to look at -- I think it was in our letter --
16 development of case studies to show how all of the
17 uncertainties would be integrated because that was
18 strictly in the model: uncertainties in the initiating
19 event, uncertainties in, you know, other parameters,
20 HRA, things that are in fire models. That's a particular
21 element, you know. It kind of goes toward Appendix B
22 in this EPRI report, but it's along those lines of either
23 developing case studies or courses or something like
24 that.

25 MR. LAI: Yes, the comment is in the letter,

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1 the staff saying when they have --

2 CHAIR STETKAR: Right, right.

3 MS. PRESLEY: And there have been some users
4 who have been very vocal on how much they're struggling
5 with this.

6 CHAIR STETKAR: Oh, sure.

7 MS. PRESLEY: So we definitely know there's
8 at least some sort of need out there. Whether it's just
9 those few vocal or more widespread, I'm not sure. So
10 the last -- are there any other specific comments on
11 the appendices?

12 CHAIR STETKAR: No, I read through dutifully
13 all of the appendices, and I thought the examples were
14 quite good. You can come up -- I don't think it's ACRS's
15 role to come up with details of, gee, this ought to be
16 different --

17 MS. PRESLEY: We did get substantial public
18 comments on Appendix E, so that one is the one that's
19 likely to get some updating.

20 CHAIR STETKAR: Now, Appendix E, my only
21 comment on Appendix E -- I did have a comment on Appendix
22 E. Thank you for the help. And I already actually made
23 it in a snide remark as an aside. Appendix E is, there
24 are examples in there that say, and I'm not going to
25 take the time to go find it right now, but example saying,

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1 well, I did this analysis using, for example, MELCOR
2 or MAP. The biggest source of uncertainty might be
3 comparing MELCOR versus MAP, you know. And that whole
4 notion of model uncertainty is absent in Appendix E.
5 It's looking at, primarily, variations in, I mean, it's
6 phenomenologically uncertainty, it's got all of the bells
7 and whistles in there. It looks at variations in
8 parameters within the context of a particular consensus
9 model that you've selected, but it does not address this
10 notion that if you selected the other consensus model
11 you might get different results.

12 MR. PARRY: And that, actually, might be
13 more relevant because I think the trouble with Level
14 2, as you know, is that it's all epistemic uncertainty.

15 CHAIR STETKAR: Sure.

16 MR. PARRY: So a lot of those things are
17 already in the containment event trees or development
18 of those scenarios. So it's a little tricky one to develop
19 I think.

20 CHAIR STETKAR: It is. That's the only
21 comment I had sort of on Appendix E, generically.

22 MS. PRESLEY: Okay. And the last slide are
23 next steps. As we've mentioned, it's already been sent
24 out for review, and that was sent to the EPRI PRA scope
25 and quality users group, and it was sent to Mary Drouin's

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1 group. And like we had mentioned, there were no
2 fundamental issues, just mostly clarification, and you've
3 seen the changes reflected in his presentation.

4 So, initially, we were in sync schedule-wise
5 with 1855. Best laid plans of mice and men. We are still
6 on track for publishing in December 2012, and that will
7 be before the anticipated release of NUREG-1855 Revision
8 1. So we are now out of sync.

9 We have in our document a lot of references
10 to sections, but they're fairly high-level section
11 references, and we don't anticipate those section
12 references to change. From our perspective, as long
13 as the draft guidance is published prior to December
14 2012, and, as Mary had indicated, they are already going
15 through the widgets to get it out, that's sufficient
16 for our purposes. And that also solves, I think, your
17 problem that you need ours published before you can publish
18 yours because you need to reference our full document.

19 So we're okay with that, I think. We're absorbing the
20 risk of public comments completely disrupting 1855, so
21 we don't anticipate that happening. So that's the plan
22 forward.

23 MR. PARRY: Okay.

24 MS. PRESLEY: Okay. Thank you very much.

25 CHAIR STETKAR: Anybody have anymore

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1 comments or questions for EPRI?

2 DR. BONACA: One question that was raised
3 but not answered was why two documents? I think that
4 it seems to me there would be a better beneficial effect
5 if they were combined.

6 CHAIR STETKAR: You know, we can't -- I fully
7 agree. I mean, I don't know whether it's --

8 DR. BONACA: We all agree probably.

9 CHAIR STETKAR: No, that's what I mean, the
10 EPRI document. We can address the other issue, but the
11 EPRI documents, it would hang together so much better,
12 especially because now Appendix A example in the current
13 document is more relevant to the table of sources of
14 model uncertainty in that other one. The whole state
15 of knowledge correlation stuff, I mean, that comes over
16 directly. And you would only have one section, whatever
17 they are, three and four --

18 MS. PRESLEY: Right. I think we can look
19 at that and look at that probably pretty carefully to
20 see how logistically difficult it would be. But the
21 way it evolved, initially, they were two completely
22 separate sets of guidance. And once we ported over chapter
23 four, things got fuzzy.

24 CHAIR STETKAR: But you ported over chapter
25 four and what's now the example in Appendix A.

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1 MS. PRESLEY: Yes.

2 CHAIR STETKAR: In terms of what Dennis was
3 talking about, you know, it's relationship to sources
4 of modeling uncertainty. Well, the most relevant ones
5 are over in that other report.

6 MS. PRESLEY: Yes, yes.

7 CHAIR STETKAR: Regardless of whether you
8 want to put links into some of the other, you know, A,
9 B, C, D, E.

10 MS. DROUIN: Well, you know, it is not an
11 easy thing for NRC EPRI to write a combined report, and
12 I can give you all the nightmares that happen on 6850
13 on the fire.

14 CHAIR STETKAR: At this level, I'm not
15 talking about integrating 1855 and EPRI report. I'm
16 strictly talking about 1026511 and 1016737, making it
17 a single report.

18 MS. DROUIN: We agree with that.

19 MEMBER BLEY: Without disagreeing, almost
20 the same stuff.

21 MS. PRESLEY: So we're going to, we're going
22 to -- it hinges on whether or not we can actually do
23 the clean-up of the references and everything to smush
24 it into one document before we need it published. And
25 we may consider publishing what we have now as an interim,

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1 and then smushing them together. But comment well taken.

2 Yes, definitely comment well taken.

3 CHAIR STETKAR: Anything else for EPRI?

4 MS. PRESLEY: I do have a comment towards
5 why NRC versus EPRI document.

6 CHAIR STETKAR: Okay.

7 MS. PRESLEY: I think there are some benefits
8 of having EPRI document a little bit separately because
9 it gave us the chance to provide some of the guidance
10 that the NRC wouldn't have necessarily felt comfortable
11 putting in and endorsing, like the defense-in-depth stuff.

12
13 MS. DROUIN: I can tell you I think it was,
14 we've got a better product by not having a combined effort,
15 a much better product.

16 CHAIR STETKAR: I'd like to address some
17 of that when Mary gets in the --

18 MS. PRESLEY: Maybe that was a con for you.
19 Okay.

20 CHAIR STETKAR: We've had some internal
21 discussions about confusion.

22 MEMBER BLEY: If they could disavow hunks
23 of the other one --

24 CHAIR STETKAR: Yes, I mean, that's, I wanted
25 to hear -- I understand how your document hangs together

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1 and why. There must be a rational of why it's not issued
2 as a joint, you know, NUREG.

3 MS. PRESLEY: I can blame it on my
4 predecessor.

5 CHAIR STETKAR: It sounds like it's probably
6 a staff decision, not an EPRI decision. Maybe not.

7 MS. PRESLEY: I don't know the history well
8 enough. I'm sorry.

9 MS. DROUIN: Are you going to, can we take
10 a break?

11 CHAIR STETKAR: We can, yes. If we want
12 to take a break -- in the interest, I know Bill has to
13 leave fairly close to 5, so can we keep it until 5 after
14 4, 12 minutes?

15 MS. DROUIN: We don't have a full hour
16 presentation.

17 CHAIR STETKAR: You don't think. So we'll
18 recess until 5 after 4.

19 (Whereupon, the foregoing matter went off
20 the record at 3:51 p.m. and went back on
21 the record at 4:02 p.m.)

22 CHAIR STETKAR: Let's get restarted and hear
23 from the staff on 1855. Mary?

24 MS. DROUIN: Okay. At the table with me
25 is Anders Gilbertston from the staff and Jeff LaChance

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1 from Sandia. I just want to acknowledge two other major
2 members of the project team is John Lehner from Brookhaven
3 and Tim Wheeler from Sandia. They couldn't be with us
4 today. So we're going to very quickly just go through
5 the objectives and the background, re-educate ourselves
6 on how the document was restructured from the original
7 version, do a summary of the feedback we got at the last
8 subcommittee, how we changed the NUREG, and then what
9 are our steps forward.

10 Okay. On the, you know, objectives, it had
11 a very narrow focus. This could have been written to
12 deal with uncertainties across all risk-informed decision
13 making. But it was to provide guidance with regard to
14 identifying and characterizing the uncertainties
15 associated with PRA, performing uncertainty analyses
16 to understand the impact of the uncertainties on the
17 results of the PRA. And this one was more in line to
18 support the PRA standard where the PRA standard was
19 requiring you to identify and characterize, and this
20 was giving the means of how to do that. And how do you
21 factor the results of your uncertainty analyses associated
22 with the PRA into your decision making?

23 We started this project, and we found out
24 at the time that EPRI had a similar project going on
25 for some months. So under our MOU, we got together,

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1 and it was decided to do a collaboration of our two projects
2 and to trade information and to, hopefully, you know,
3 issue reports that were complimentary. And it turned
4 out at the time that there was a good division of the
5 labor, so we kept with that. And I think that the documents
6 have served well and worked well together and done in
7 a very efficient manner.

8 CHAIR STETKAR: Now it's probably time to
9 ask you, given that and given kind of the character and
10 nature, I'll use NUREG/CR-6850 as an example of a combined
11 EPRI/NRC report, obviously there was an active decision
12 to keep them separate. It's not entirely clear to me
13 why, given, you know, if I read 1855 now, because it
14 liberally cites, as you mentioned, specific sections
15 of the EPRI report, it lists both of those EPRI reports
16 for examples to go look at these reports. Initially,
17 I thought, well, there was, for some reason, that Dennis
18 mentioned that it gives the staff the opportunity to
19 essentially not endorse specific sections of those
20 reports, but I haven't found any places where they're
21 not endorsed.

22 MEMBER BLEY: Or cited.

23 CHAIR STETKAR: Or cited. And the NUREG,
24 I guess, doesn't endorse something but . . .

25 MS. DROUIN: Well, we don't have a blanket

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1 endorsement of their document anywhere. We do refer
2 to specific places in the document where we say go look
3 at this, this has good information in it. And those
4 were -- excuse me. I'm getting over a cold. Those were
5 the, you know, appendices that give the list of sources
6 of model uncertainty. And the staff was heavily involved
7 in the first one in doing a lot of review of it. The
8 second one in this most recent, we were heavily involved
9 because that came out of a joint workshop. And we produced
10 the technical report, all those tables, which EPRI used
11 extensively. So for that part of it, you know, we were
12 involved.

13 But if this had been a combined report, I
14 don't think we would be along where we are today because
15 it would have constituted a much deeper involvement of
16 the staff, you know, because now we would have to read
17 it, you know, agree to the actual language, how something
18 is worded, make sure it doesn't have an implication on
19 a staff position we can't live with. So in this way,
20 you know, we haven't given a regulatory endorsement of
21 the document in that sense.

22 CHAIR STETKAR: What I was going to ask,
23 though, and I need help on this because Reg Guide 1.174
24 does, indeed, refer to NUREG-1855 in several places for
25 guidance on treatment of uncertainties.

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1 MS. DROUIN: Yes.

2 CHAIR STETKAR: NUREG-1855 now refers to
3 an EPRI report for examples let's call them. This notion
4 of, is there a danger that someone will say, well, I
5 followed, I used the EPRI report; therefore, by
6 implications, I met the guidance in Reg Guide 1.174?
7 Because 1.174 doesn't say anything about the EPRI report.

8 It doesn't say it endorses the EPRI report, except for,
9 you know, I'll use, since somebody else brought it up,
10 the section on defense-in-depth. It doesn't say that.

11 NUREG-1855 doesn't say this is all good except for the
12 section on defense-in-depth. So there seems to be a
13 danger that nobody disavows anything anywhere. Now,
14 perhaps you look at it and the fact, you know, a very
15 narrow sense that the specific things that are cited
16 in NUREG-1855 are the things that you like. And if you're
17 silent about everything else, by implication, you're
18 silent and, therefore, there's some question. I just
19 can't follow the string.

20 MS. DROUIN: The NRC historically has
21 referenced industry documents. There's a difference
22 between referencing an industry document and endorsing
23 an industry document.

24 CHAIR STETKAR: Right.

25 MS. DROUIN: And we have historically

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1 referenced a lot of industry documents that go out, we
2 say go out there, that's good information there. So
3 there's always that danger --

4 CHAIR STETKAR: Okay.

5 MS. DROUIN: -- you know, that's always in
6 there. But there is a difference between, because if
7 we say we endorse it, then that means we have, yes, you
8 follow that, we don't have a problem.

9 CHAIR STETKAR: And you don't see a danger
10 with this just because the way the daisy chain is --

11 MS. DROUIN: No.

12 CHAIR STETKAR: Okay, okay.

13 MS. DROUIN: No. So, you know, as you're
14 aware, the major change we made was a restructuring of
15 the document that gives a much better explicit process
16 on the guidance, and the scope was expanded, which really
17 primarily affected EPRI and not us, to address low-power
18 shutdown, internal fire, seismic, and Level 2. We met
19 with the Subcommittee back in June to present the version.
20 You all gave us some feedback, and we have systematically,
21 hopefully, addressed your concerns, which we're going
22 to go through.

23 CHAIR STETKAR: Mary, when you turn your
24 page, be careful on the microphone. When you hit it,
25 it explodes in her ears, and it's --

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1 MS. DROUIN: Sorry about that. This is just
2 a diagram that just shows how the document was restructured
3 and how it's now organized. And it starts off at a high
4 level with stage A telling you whether or not the
5 risk-informed application has to follow this guidance.

6 And we did take into account and we had said it a couple
7 of places that's generic, and we elaborated more in this
8 next version on that. And then stage B through stage
9 F is the guidance for the licensee to follow in how to
10 address the uncertainties as he's pulling together his
11 application. And then the right-hand side is the stage
12 G, and that's the NRC risk-informed review process.
13 And then supporting both of these is the risk-informed
14 decision-making process and the ASME and ANC PRA standard
15 because the standard does require you to deal with
16 uncertainties, and this document is answering those
17 requirements of providing the how-to because, if you
18 remember, the standard is a what to do.

19 MEMBER BLEY: Just enlighten me a bit on
20 how we get from a NUREG to guidance. So we use a reg
21 guide then to point to the NUREG to essentially say this
22 is good guidance to follow.

23 MS. DROUIN: A NUREG can be a guidance
24 document.

25 MEMBER BLEY: And it doesn't need a reg guide

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1 to point to it?

2 MS. DROUIN: No, we have NUREGs that are
3 guidance documents themselves that could -- usually,
4 the NUREG or the reg guide will point back to something.

5 MEMBER BLEY: Yes.

6 MS. DROUIN: You know, so we do have reg
7 guides that do reference 1855 in other documents.

8 MEMBER BLEY: That's what I was thinking.

9 You had to have that to make the link, but you don't
10 need that. You just say that guidance is okay --

11 MS. DROUIN: Right.

12 MEMBER BLEY: -- if it's in the NUREG?

13 MS. DROUIN: Yes.

14 MEMBER BLEY: Okay.

15 MS. DROUIN: So on this sheet, we tried to
16 summarize the feedback that we thought we received from
17 the ACRS Subcommittee. We had taken some notes, and
18 we sent them to get feedback, and we really appreciated
19 your feedback on it. So we've tried to summarize it
20 here into one graph. One was to go through and re-evaluate
21 the use of subjective terms, and I'll come back to these,
22 each of them individually, and my two colleagues will
23 jump in and save me when I don't say it correctly.

24 Address issues regarding the sources of the
25 model uncertainty, particularly the definition of

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1 consensus model; clarify the relationship of uncertainty
2 in PRA and deterministic analyses with defense-in-depth
3 and safety margin. And this gets into the risk-informed
4 decision, the integrated risk-informed decision making
5 process.

6 Consider inclusion of a more generic global
7 process for the application of the NUREG; expand the
8 discussion on bounding conservative and realistic
9 analyses; re-evaluate the discussion on the process of
10 truncation, particularly with regard to its importance
11 on the state of knowledge correlation; and then revisit
12 the discussion of a reasonable alternative for a
13 sensitivity analysis. So, in my mind, these were the
14 seven big ticket items that you all had asked us to go
15 look at.

16 So we actually did do a, I'm not saying that
17 we didn't miss something but --

18 CHAIR STETKAR: I don't think you missed
19 this one.

20 MS. DROUIN: I'm sorry?

21 CHAIR STETKAR: I don't think you did miss
22 any on this one.

23 MS. DROUIN: We tried to go and do, literally,
24 a line-by-line search for subjective terms, and pretty
25 much the thing we found was reasonable and credible.

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1 And I can't promise that we caught them all, but we did
2 try and replace -- we thought, after a long discussion,
3 that credible was the better term to use than reasonable.

4 CHAIR STETKAR: Regardless of the word,
5 credible is now defined.

6 MS. DROUIN: And we defined it.

7 CHAIR STETKAR: You defined it. So at least,
8 you know, people may argue with that definition, but
9 you've at least stated what that thing means.

10 MS. DROUIN: Right. And there were places
11 where we thought the term wasn't needed so --

12 CHAIR STETKAR: Right. In some places just
13 --

14 MS. DROUIN: -- in some places, we just got
15 rid of it.

16 CHAIR STETKAR: That's right.

17 MS. DROUIN: But in some places, it really
18 was, and so when it was we went with the term credible
19 --

20 CHAIR STETKAR: Honestly, Mary, I read
21 through this thing with kind of a fine-tooth comb, and
22 I think you've done a really good job in terms of removing
23 what we raised as a concern about this kind of vague
24 notion of what is reasonable.

25 MS. DROUIN: Right. And then there was the

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1 term "broad acceptance" that was used in the definition,
2 and we had a lot of discussion on that, and we finally
3 came to the conclusion it didn't add anything. So we
4 removed it from the definition. But, you know, in terms
5 of subjective terms, that's all we could really find,
6 and we really did take the time and effort to do a thorough
7 scrubbing. So if there are other subjective terms you
8 think we missed, we'd like to hear about them.

9 Okay. Changes to the NUREG, and this is
10 to deal with the definition of sources of model
11 uncertainty. And when you go in on page 18, you'll see
12 there may be cases of more than one consensus model.
13 And I'm trying to remember exactly what we did here.

14 MR. LACHANCE: Let me help you. I think
15 the general comment -- this is Jeff Lachance, by the
16 way. The general comment or one of the general comments
17 we got was what do we do about the case of consensus
18 model if there's really more than one. And we tried
19 to address that with this language that's shown on the
20 slide, and we recognize that there could be multiple
21 consensus models but the definition of that, if there
22 are, they essentially have to give you similar results.
23 If they don't, then how could they really be, you know,
24 two different consensus models that give you --

25 CHAIR STETKAR: Kind of like MAP and MELCOR.

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1 MR. LACHANCE: Yes. We give you orders of
2 magnitude difference, okay? And so we put that into
3 the document, and we also recognize the fact that EPRI,
4 as a document, is listed in the second paragraph. That
5 was the first step in establishing a process for compiling
6 them, okay? It hasn't gone any further than that EPRI
7 document. The NRC hasn't endorsed the models that were
8 identified, but some of them probably have been endorsed
9 in particular applications. And so we added that
10 language.

11 MS. DROUIN: So the other thing is that we
12 don't know, if the time is available, whether it's worth
13 to take the time to start with the list that's in the
14 EPRI document and to try and identify are any of those
15 consensus models. I don't know if we can come to that
16 kind of agreement in the time frame that's available
17 and whether that would be worthwhile.

18 CHAIR STETKAR: You know, quite honestly,
19 this is my own perspective, I thought this was really
20 good. You didn't point to EPRI as examples, but I kind
21 of agree with you that trying to define what are the
22 officially-sanctioned consensus models might be a rabbit
23 hole that you don't necessarily want to run down right
24 at this time, given the general --

25 MS. DROUIN: It sounded like a good idea

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1 when --

2 CHAIR STETKAR: -- resources might be spent
3 much more effectively in other ways. I'd rather see
4 a training. Take those resources and do some training
5 courses on, you know, realistic examples or something.
6 I thought this was really good.

7 MS. DROUIN: And exactly what you said is
8 why we didn't progress further.

9 CHAIR STETKAR: One of the things regarding
10 consensus models -- maybe it's addressed on the next
11 page. Go the next page.

12 MR. LACHANCE: So this part addresses, you
13 know, the definition of source of model uncertainty,
14 and there were some slight changes made to the definition
15 that was in the previous version. Basically, it sort
16 of indicates the change was made to reflect the fact
17 that a credible assumption could be submitted by a single
18 expert. And what it didn't have to do is it didn't have
19 to receive broad acceptance. That's where we made the
20 major change here. In step one, we removed broad
21 acceptance, and this is the area where we did it because
22 we didn't think that was necessary. A single expert
23 may come up with a very good and credible alternative
24 method. That could be the source of a model, a sensitivity
25 study to address model uncertainty. I think that's the

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1 major change that was made here.

2 MS. DROUIN: And we've seen a lot of examples
3 of that in the past, particularly in the seismic area
4 where you have a single expert, you know, that does not
5 have the broad, but it's a source of model uncertainty
6 even though it has not received broad acceptance.

7 CHAIR STETKAR: One of the things, a note
8 that I made to myself as I was going through this, I
9 think the previous slide did a very good job of kind
10 of clarifying this notion of having two nominal credible
11 consensus models, and what does that really mean, and
12 I guess this addresses it. I've been really sensitive
13 to the thing that I brought up earlier regarding suppose
14 I have one, every consensus model, everybody agrees that
15 this is the best available consensus model, how do I
16 treat the fact that I still have uncertainties in the
17 results from using that model? I'm propagating
18 uncertainties in the parameters that that has --

19 MEMBER SHACK: It should also be noted that
20 the adoption of a consensus model would not negate the
21 need to model any parameter uncertainty.

22 CHAIR STETKAR: Yes, yes. And I think this
23 does it. I think this handles that.

24 MS. DROUIN: It doesn't get rid of the
25 uncertainty. It's just that everybody agrees as to what

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1 that uncertainty is, and I think that's what the subtle
2 difference is. Okay. On the third one, we just added
3 some more language to better tie in the different
4 principles of your integrated decision to the PRA and
5 to risk and that they weren't always isolated. You know,
6 they were integrated, so we just brought that clear into
7 the picture. And then we did delete the one picture
8 that you didn't like, and trying to add verbiage to better
9 explain it, it got difficult. And then we stood back
10 and we said, well, you know, the real thing here is the
11 integrated decision making with the different principles
12 and not this other figure. So we thought it was better
13 off just to --

14 CHAIR STETKAR: Oh, yes, yes, yes, yes.

15 MS. DROUIN: -- keep that figure, which is
16 what we did.

17 CHAIR STETKAR: Yes.

18 MS. DROUIN: When you look at the NUREG,
19 we did say in the scope that, you know, this is limited
20 to this, but the process is generic and is applicable.

21 And then we had the first stage, which goes to where
22 you apply it. And we still acknowledge there that it
23 has a generic process. So what we did is we added a
24 new subsection so that -- and it got into the three main
25 things you have to deal with so that if you got into

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1 the block that didn't send you, that this NUREG, that
2 you had to go through the rest and follow it explicitly,
3 we do now have a subsection in there saying, okay, here's
4 how you apply it generically at a higher level.

5 CHAIR STETKAR: One of the questions I had
6 on this, though, Mary, first of all, you may want to
7 read through that section because I had a really difficult
8 time. I sort of saw what you were trying to say, but
9 it didn't flow very well. One of the comments that we
10 made, and this wasn't changed in the NUREG, there's a
11 statement that says, "Internal NRC activities may use
12 risk results and insights. However, the treatment of
13 the associated risk uncertainties are not subject to
14 the process in this NUREG. While the risk analyses
15 associated with NRC activities do have uncertainties,
16 the treatment of these uncertainties is addressed by
17 a different process that is outside the scope of this
18 NUREG," and now there's a parenthetical "see section
19 3.4." And there are several -- I mean, when you talk
20 about the Reactor Oversight Process, everything points
21 to this new section which is now a very broad sense of,
22 oh, yeah, you have to think about uncertainties in a
23 systematic way. But I still have a problem of why,
24 internally, the NRC staff doesn't have to go through
25 the same type of systematic assessment of uncertainties

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1 that's laid out in this NUREG and now, by implication,
2 in the EPRI report.

3 So, for example, if I'm using a SPAR model
4 to make a decision about the relative risk of something,
5 why don't I, as a staff member, need to also quantify
6 my uncertainties through that SPAR model? Isn't that
7 a PRA?

8 MS. DROUIN: I'm not going to get into some
9 of those issues. What we are trying to say when you
10 don't have to file a -- 1855 gets very specific of the
11 things you have to think about. But the process itself,
12 you would have to think about that any time you're dealing
13 with uncertainties. So I think what you read is not,
14 we did not word that well enough because it makes it
15 sound like there's something totally different.

16 CHAIR STETKAR: You may want to go back and

17 --

18 MS. DROUIN: And that was not the intent

19 --

20 CHAIR STETKAR: -- read those things because
21 I was trying to be very sensitive to this. And places
22 that I flagged back in June where I thought that the
23 NUREG was promoting this approach, let's say for the
24 industry, and, yet, a different approach ill-defined
25 at that time for internal NRC decision making, every

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1 place that I had flagged back in June now has a parenthesis
2 that says "see section 3.4."

3 MS. DROUIN: Right. And what we were trying

4 --

5 CHAIR STETKAR: And 3.4, quite honestly,
6 leaves me a bit empty because 3.4 is just very high level
7 and qualitative and it gives me the impression that staff
8 decisions, I'll come back to using a SPAR model, that
9 staff input to the decision-making process that's derived
10 from something like using SPAR models for two or three
11 different plants to draw generic conclusions, which is
12 done, are not subject to quantitative evaluation of
13 uncertainty or this systematic process that is, indeed,
14 laid out really well in 1855.

15 MS. DROUIN: Well, the thing that, you know,
16 we have to be careful with in 1855 and why, you know,
17 we may not make you happy is, you know, because we haven't
18 gone through, and I didn't have a problem with writing
19 3.4 and keeping it high level. Now, we may have erred
20 in keeping it too high level, but it can't get real detailed
21 because we haven't gone through and vetted, you know,
22 is this really, you know, can I just take all the details
23 that are in 1855 and say, yes, this is exactly what you
24 would do for SPAR models or for ROP. I know at a high
25 level that you're going to have to understand the activity,

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1 you're going to have to understand the sources, you're
2 going to have to address the uncertainty, you know, so
3 that high-level process is certainly applicable.

4 CHAIR STETKAR: Let me ask it a different
5 way is in 1855 and, in particular, the guidance, the
6 more detailed guidance in the EPRI report, there are
7 many instances that says, well, you need to think about
8 these things but there may be alternative ways to address
9 them. You know, we had this discussion about what does
10 it mean to do a sensitivity analysis or, if you can't
11 estimate the frequency of a cliff edge effect, how you
12 might address that. That's a way to address that
13 uncertainty. Why shouldn't the NRC staff, why shouldn't
14 the guidance just say follow the process in 1855, period?

15 Whether you're NRC staff, whether you're a consultant,
16 whether you're an applicant, what's wrong with that?
17 Why can't the NRC staff do that? Because the process
18 in 1855 and the EPRI reports says, in some cases, you
19 may need to develop alternative arguments rather than
20 a rigorous treatment of uncertainty.

21 MS. DROUIN: I would be hesitant to do that
22 at this point on programs that are well established and,
23 all of a sudden, coming in and telling them, okay, now
24 when you're in your decision making, you need to explicitly
25 do these things that are in 1855. I'm not ready to retire

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1 yet.

2 CHAIR STETKAR: It's just -- okay. I hear
3 you. I understand the constraints. But at some level,
4 you know, we pride ourselves as an agency of using risk
5 information and uncertainty as part of that risk
6 information, and it doesn't quite seem fair in the sense
7 of trying to develop a lot of guidance from what we expect
8 people to deliver to us and not hold ourselves to that
9 same standard, if you will.

10 MS. DROUIN: Right. And I appreciate that.
11 But I guess, from a personal perspective, I also come
12 back to when we wrote 1855 we really had blinders on.
13 We really were thinking, you know, very narrow
14 applications.

15 CHAIR STETKAR: Risk-informed
16 applications. I understand that.

17 MS. DROUIN: And that's where we came from.

18 CHAIR STETKAR: Yes.

19 MS. DROUIN: And so then after doing it we
20 thought, well, you know, this process at a high level,
21 it's pretty generic. So we wanted to communicate that,
22 but we haven't systematically gone through and said,
23 okay, and tried it out in these other applications to
24 say would I want, would I go and change something in
25 one of these chapters for it to fit? And that's what,

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1 you know, I would be hesitant about. Mark, do you want
2 to --

3 MR. RUSSO: Perhaps I can add some value
4 and perhaps not.

5 CHAIR STETKAR: Mark, just for the record,
6 can you --

7 MR. RUSSO: Oh, Mark Russo, NRO. I think,
8 first, I think the point about why shouldn't the NRC
9 live up to the same standards that other organizations
10 do when they do analytical work, everybody in the room
11 agrees that, to the extent that it's appropriate, you
12 know, you should. You know, I think we went through
13 this with QA of the SPAR models and QA of other stuff
14 where, you know, we have strong QA standards, but ten
15 years ago or something we weren't QAing our own things.
16 We were running calculations and making decisions.
17 So I think we agree there.

18 The point I would make is I think perhaps
19 that it's probably more appropriate in whatever guidance
20 exists for the particular application, be it the STP
21 process or be it a calculation of a change in risk or
22 a risk associated with an event, whatever guidance we
23 have for staff in those programs, that that's where they
24 should be looking at, you know, how would one apply this
25 and to what extent should they apply it, if it's, you

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1 know, something very, very simple, a risk-informed scoping
2 kind of tool, maybe you don't need to do all this. So
3 I guess what I'm saying is maybe it's better for this
4 to be the kind of thing that's addressed in the methodology
5 of guidance for a particular application.

6 CHAIR STETKAR: You know, I understand that,
7 but in 1855 there's not, maybe I'm misinterpreting it,
8 but 1855 does not contain that level of specificity.
9 It doesn't say if you're doing a risk-informed submittal
10 for a change in the surveillance interval for a diesel
11 generator of how you should address uncertainty within
12 that, which is what I'm hearing you say that the specific
13 guidance for each application needs to reflect details
14 of the process. This is a much higher document. It says,
15 you know, you have to systematically address
16 uncertainties. Here are the types of uncertainties that
17 you need to consider. You need to consider parameter
18 uncertainties. You need to consider modeling
19 uncertainties, regardless of your own opinion about
20 whether you're closer or far away from a threshold
21 uncertainties may be more or less important to your
22 ultimate decision. And I don't understand why, at that
23 level, it doesn't apply universally. Why, if I'm close
24 to making a decision on STP, of whether I'm green to
25 white or white to yellow or whatever, why it might not

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1 be more important to assess uncertainties. You see
2 numbers coming in that says, well, condition to core
3 damage frequency or probability was 1.23 times 10 to
4 the minus 3, so it's, you know, whatever color it is,
5 without any expression of uncertainty that there's a
6 90-percent probability that it might still be green.
7 That still might be enough to make the decision that
8 you trip over it to the next level, but it's kind of
9 inconsistent of what we're asking people to do coming
10 in from the outside and submitting things. How you do
11 it, whether it's a significance determination process
12 or other types of application that the agency gets involved
13 in, is more detailed-focused guidance, but I just don't
14 understand why we need the statements in here saying
15 that internal NRC needs some different process of thinking
16 about this stuff at this level, at the level of the guidance
17 in the NUREG. I'll just leave it, you know.

18 MEMBER BLEY: It's not so much saying use
19 it everywhere as not saying don't use it.

20 CHAIR STETKAR: That's right. That's
21 right.

22 MEMBER BLEY: And you can still keep your
23 job.

24 MS. DROUIN: I was being facetious there.

25 MEMBER BLEY: Can I ask a specific question?

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1 MS. DROUIN: Sure.

2 MEMBER BLEY: This new section I don't think
3 got reflected up into the abstract.

4 MS. DROUIN: You know, you're probably
5 right.

6 MEMBER BLEY: And I think right at the end
7 of the first paragraph of the abstract another sentence
8 or two would do it because you'll be talking to the rest
9 of staff, and getting it out in front I think is useful.

10 MS. DROUIN: You're correct. I did not catch
11 the abstract.

12 MEMBER BLEY: And the way that first
13 paragraph is written, it almost invites the next sentence
14 that says and, therefore, it could be used more generally.

15
16 MS. DROUIN: Okay. The next one on bounding
17 analyses.

18 MR. LACHANCE: Yes, Jeff LaChance. This
19 one is we just sort of added an extra paragraph there
20 to try to provide a little bit more explanation. That
21 extra paragraph sort of addresses the fact that, you
22 know, in reality, when you do a bounding analysis, it
23 might represent, on a probabilistic level, you know,
24 some high percentage on distribution. But I also
25 recognize that's not practical to do that, okay, specify

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1 a percentile in the definition of a bounding assessment,
2 even though it may turn out to be closed to one. But
3 it also leaves open the option that, well, for specific
4 parameters, you could use a 95th percentile and say,
5 well, that's close to my bounding assessment. And so
6 it just adds a little bit more guidance on what to do
7 here.

8 CHAIR STETKAR: I thought this --

9 MS. DROUIN: Well, also --

10 CHAIR STETKAR: We kicked around a couple
11 of different ideas but I . . .

12 MS. DROUIN: And we thought it was important
13 to, in this section, to keep separate and have a definition
14 for your bounding analysis versus a conservative analysis
15 versus a realistic, but those are three distinct things
16 and we needed good definitions for them. So we did get
17 rid of the frequency side, but I think we incorporated
18 it a little bit differently.

19 MR. LACHANCE: Well, actually, where it says
20 we removed that text, that one sentence, because it was
21 redundant.

22 CHAIR STETKAR: That one was, yes. But the
23 definition now gets it very much closer to this notion
24 of the worst credible outcome and so forth, which I think
25 was in there but not as succinctly.

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1 MS. DROUIN: So we can go on to six then.

2 CHAIR STETKAR: Mary?

3 MS. PRESLEY: Sorry. We had a question on
4 the last slide. So, for example, a bounding scenario
5 may be defined utilizing a bounding frequency assumed
6 failure of available mitigating systems, so that sentence,
7 that last sentence, second to last sentence. That may
8 be a little bit inconsistent with what we've been calling
9 them, and I don't know if we used the word bounding but
10 we would use a bounding consequence and a realistic or
11 conservative frequency, and we would call that a bounding
12 scenario, as well. So I just wanted to make sure we're
13 not being inconsistent or if we need to tweak our
14 terminology.

15 CHAIR STETKAR: That's something you can
16 probably work out between you.

17 MS. DROUIN: Right. We'll take a note and
18 we'll work that out with you.

19 CHAIR STETKAR: You don't need to struggle.
20 You did good here.

21 MS. DROUIN: Okay. I'm sorry. I'm not my
22 --

23 CHAIR STETKAR: That's okay. This was the
24 whole notion about at least instilling the sensitivity
25 to the notion that looking at the cut sets that you can

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1 examine might not be sufficient to examine the effects
2 of the state of knowledge correlation, that your
3 truncation frequency might have suppressed those cut
4 sets, and the revised words at least instill that notion.

5 It does it. It was adequate.

6 MR. LACHANCE: But to be fair, in the previous
7 version, we actually did have some wording in there along
8 these lines, but we just amplified it a little bit more.

9 MEMBER BLEY: If only you didn't have to
10 use the SOKC acronym. I hate it.

11 CHAIR STETKAR: You probably coined the
12 phrase. We've already talked about this, that . . .

13 MR. LACHANCE: Yes, on seven, really in the
14 first part we mention, actually for number one, that
15 we already replaced reasonable with credible. But the
16 real question that we're trying to address here --

17 MS. DROUIN: It's not reflected correctly
18 on the slide.

19 MR. LACHANCE: -- was that, you know, revisit
20 the discussion on the reasonable alternative for a
21 sensitivity analysis. We had some discussion with EPRI,
22 and I think we came to the conclusion that the EPRI guidance
23 was pretty good with regard to this. And so we just
24 simply referred to the EPRI documents for that.

25 MEMBER SHACK: You're consistent that way.

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1 CHAIR STETKAR: I know what you did.

2 MS. DROUIN: Okay. Where are we now? As
3 I started off, we're in the midst. Hopefully, it will
4 go out any day now with two-week notification to the
5 program offices. Once we hit that two weeks, then it
6 goes into the process to go to publications, and that's
7 anywhere from three to five days to get through that.

8 So looking at, you know, two to three weeks before this
9 actually comes out. So we go out for a two-month public
10 period ending at the end of December, and then we would
11 come back in January, address at that time both NRR and
12 NRO comments. We've gotten a few NRR comments --

13 CHAIR STETKAR: What we've seen has not yet
14 incorporated the NRR or NRO comments?

15 MS. DROUIN: NRR and NRO have been heavily
16 involved in this, but we send it to them formally for
17 their comments. I mean, over the time frames, we've
18 had numerous meetings, numerous discussions, showing
19 them what we've done, gotten their feedback in realtime,
20 but now it goes to them for formal and it was sent to
21 them for formal --

22 CHAIR STETKAR: So, in principle, there
23 shouldn't be any surprises --

24 MS. DROUIN: No, there should not be any
25 surprises, any surprises.

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1 CHAIR STETKAR: We can never say never.
2 Okay.

3 MS. DROUIN: So I would anticipate not
4 receiving any comments from them formally, but if there
5 are any they'll be addressed during, you know, with the
6 public review and comment. So we're looking for this
7 to be published in early 2013.

8 MR. GILBERTSON: I would just mildly qualify
9 that. I mean, our publications branch has expressed
10 that they have a fair queue of documents to review, so
11 we'll be getting it to them as soon as we can.

12 CHAIR STETKAR: Nothing that's within the
13 realm of your control, I understand.

14 MR. GILBERTSON: They have assured to a
15 certain degree that we would probably have a November
16 or December publication date for the draft.

17 MS. DROUIN: And what they do is that they
18 go through and they make sure the table of contents,
19 those page numbers, that's really the right page number.
20 So, I mean, they don't read the document. You know,
21 they're looking at it at that high level, you know, has
22 it been assembled correctly --

23 CHAIR STETKAR: Okay. Offline, I caught
24 a couple of editorial things that I'll share with you
25 offline.

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1 MS. DROUIN: Okay.

2 CHAIR STETKAR: We don't need to do it in
3 this forum.

4 MS. DROUIN: So that's where we're at.

5 CHAIR STETKAR: Great. Any questions for
6 the staff? If not, thank you very much.

7 MS. DROUIN: Thank you.

8 CHAIR STETKAR: Appreciate that. And as
9 we usually do for the Subcommittee, what I'd like to
10 do is go around the table and see if any of the members
11 have any comments and questions. But, first, since we
12 have a consultant here, I'll put him on the spot and
13 ask him first. So Mario?

14 DR. BONACA: No, I thought your argument
15 at the end of this project, but I thought that it was
16 well organized and the presentation was usable. And
17 I think that it will be a big help in the industry with
18 the PRA. So I have no other comments.

19 CHAIR STETKAR: Thank you. Dennis?

20 MEMBER BLEY: Yes, I just want to thank
21 everybody. It's been an interesting day, and this has
22 come a long way. I really like it. I think with respect
23 to the examples and things, we aren't ever going to be
24 perfect. But a few more caveats in, as we've talked,
25 I think that will help. I'll only express my

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1 disappointment that very few people from the staff were
2 at this meeting all day, and somehow the word on what
3 has to get spread pretty far because it does have broad
4 applicability. And there's lots of people who still
5 come and talk to us and say, oh, there's no way to even
6 think about those things, and you've given them a pretty
7 good framework for thinking. Thanks.

8 CHAIR STETKAR: Bill?

9 MEMBER SHACK: I'll just echo what Dennis
10 said. I think it's come a long way. I hope it gets put
11 to use.

12 CHAIR STETKAR: And me, too. It's one of
13 the reasons why I've been as animated as I am about those
14 excerpting those phrases about NRC staff using other
15 processes because I thought that that example that I've
16 cited a couple of times from the fire modeling stuff,
17 had it not been for a lot of prodding, that example would
18 not have existed because there was no sense of the fact
19 that we need to account for uncertainties at that level.

20 The document at another level accounted for uncertainties
21 in modeling.

22 So I'd echo Dennis' notion that I think this
23 is really good, and it does have broad applicability
24 and people ought not to be given a free out on --

25 MS. DROUIN: I have a question. You know,

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1 it was actually the ACRS that started this program way
2 back when. You all sent us a letter. I don't know if
3 you were planning on writing a letter on this --

4 CHAIR STETKAR: I think that's -- okay.
5 We have a December full committee meeting scheduled on
6 this topic. Don't look at me as if you're surprised.
7 It's on the schedule.

8 MS. DROUIN: No, I didn't know that.

9 CHAIR STETKAR: Talk among yourselves.
10 You're actually on our agenda for the December full
11 committee.

12 MR. LAI: I've actually sent you several
13 emails talking about it.

14 MS. DROUIN: You know, I will tell you, I'm
15 dealing with so many things right now, it's very easy
16 for an email to slip. And I know you're very good about
17 keeping informed. I'm sure it's there.

18 CHAIR STETKAR: You're on the agenda. Now,
19 whether we write a letter is something we need to discuss
20 internally, and I can't give you, you know, a notion
21 on that right now, quite honestly. I mean, I think even
22 if it were a short letter just saying it's really good
23 it might benefit a lot of people, but that's my own opinion.
24 I can't give you a statement on it. By the way, just
25 simply, if you come before the full committee, it doesn't

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1 necessarily mean we'll write a letter either.

2 MS. DROUIN: I recognize that. That's why
3 I was . . .

4 CHAIR STETKAR: But you are on the agenda,
5 and if that's going to change we need to know about it.

6 And right now I'm personally open. I don't know whether
7 we'll write one or not. One last thing I'd like to say
8 is just to reiterate if there's any way that EPRI can
9 re-read your report with a really cynical set of goggles
10 on and try to see where people might misinterpret it
11 as the bare minimum that's necessary and sufficient.
12 And I recognize you can't put enough caveats in there,
13 in practice, to resolve that problem. You can't have
14 enough examples. You know, you just can't. But there
15 might be a few ways that you can recast a few things
16 without too much work to at least better thwart off that
17 sort of mind set. It might help.

18 With that, thank you again. I appreciate
19 it, especially on a Friday afternoon. And we are
20 adjourned.

21 (Whereupon, the foregoing matter was
22 concluded at 4:54 p.m.)
23
24
25

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Practical Guidance on the Use of PRA in Risk-Informed Submittals with a Focus on the Treatment of Uncertainties [1026511]

Mary Presley EPRI

Gareth Parry, Doug True, Don Vanover ERIN Engineering

**Advisory Committee on Reactor Safeguards Reliability and PRA
Subcommittee Meeting**

October 19, 2012

Overview

- Project History
- Ongoing Collaboration with the NRC
- New EPRI Guidance
- Next Steps

Project History

- Complementary documents addressing uncertainty analysis in risk-informed decision making using PRAs were prepared under a memorandum of understanding between EPRI and the Office of Research of NRC
 - NUREG-1855, Revision 0, *Guidelines on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decision Making*, March 2009
 - EPRI 1016737, *Treatment of Parameter and Model Uncertainty for Probabilistic Risk Assessments*, 2008
 - Guidance on SOKC and characterizing model uncertainty
 - Lists generic sources of model uncertainty in internal events
- Prior work by EPRI provided significant technical information
 - EPRI 1013491, *Guideline for the Treatment of Uncertainty in Risk-Informed Applications: Applications Guide*, 2006

Ongoing Collaboration with NRC

- NRC decided, based on comments from NRR and NRO to produce Revision 1 to NUREG-1855.
 - Revision 1 is a reorganization of Revision 0
 - EPRI document is intended as a companion to the revision; it takes the stages defined in NUREG-1855, Revision 1 and demonstrates how and when to apply them
- Expansion of list of generic sources of model uncertainty needed to expand scope
 - NRC/EPRI sponsored a workshop (February 28 – March 1) to solicit input to identification of sources of uncertainty in PRAs for fires, seismic, low power and shutdown and Level 2

New EPRI Guidance

- A pragmatic approach to developing a risk-informed proposal factoring in the uncertainties in the PRA results for the purpose of risk-informed decision making
 - Decomposition and interpretation of PRA results
 - A graded approach to dealing with parameter & model uncertainty based on Regimes (NUREG 1855, Rev 1)
 - Interaction between principles of risk-informed decision-making
 - Dealing with large uncertainties
- Example Implementation (Appendix A)
- Expanded tables on sources of model uncertainty for:
 - Seismic hazard group (Appendix B)
 - Fire hazard group (Appendix C)
 - LPSD operational states (Appendix D)
 - Level 2 (Appendix E)

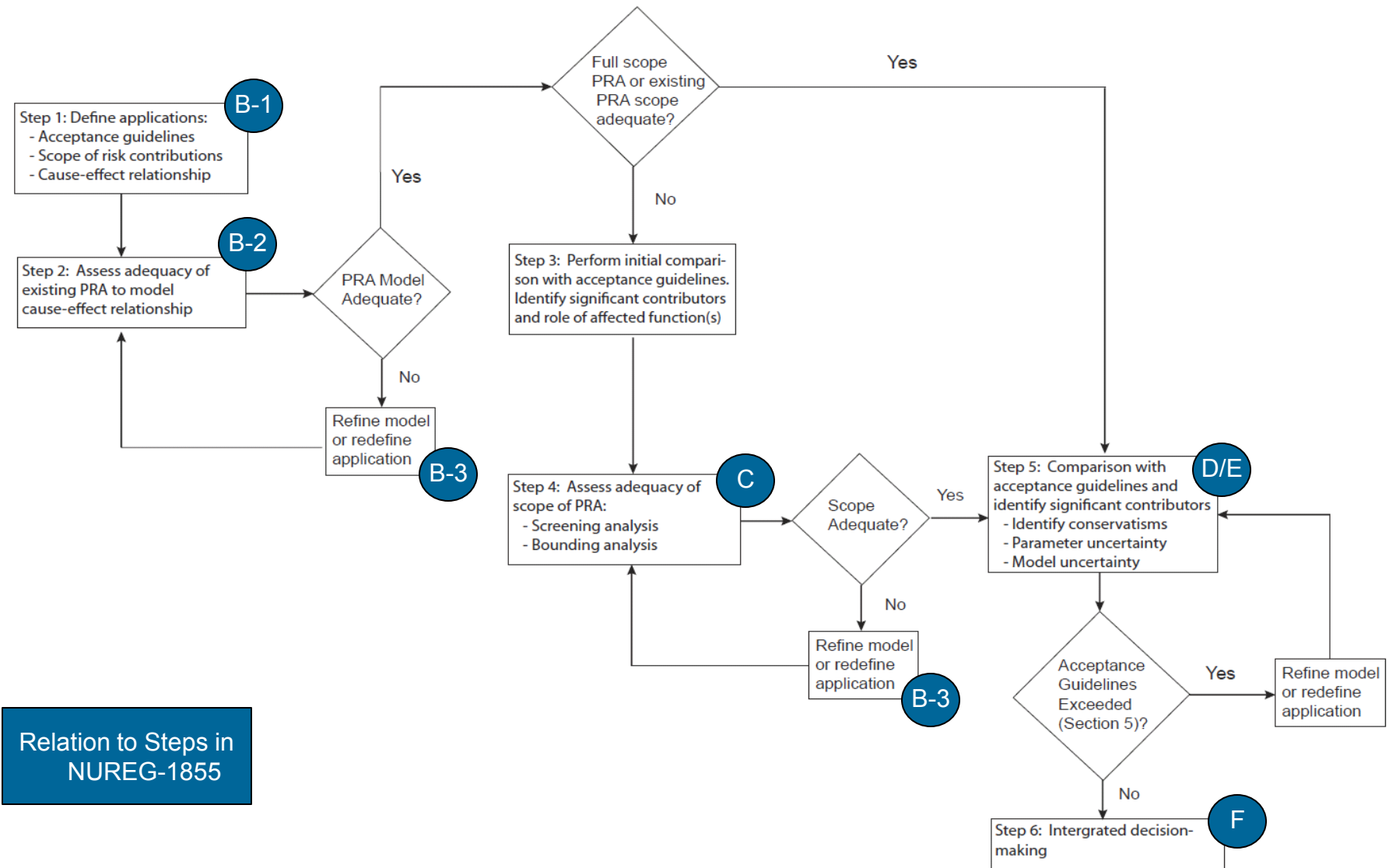
Assumptions

- Risk-informed submittal is developed in accordance with guidance documents such as RG 1.174
- Generally such submittals require considerations of all contributors to risk (e.g., all hazards and POSs)
- Currently very few licensees have a full scope (all hazards, all POSs) PRA
 - Process developed to facilitate screening or bounding of missing scope items
 - These steps can be bypassed for a full scope PRA or a PRA of sufficient scope for the application
- Guidance needed on interplay of principles of risk-informed regulation, particularly the DID principle

Assumptions (Cont'd)

- The starting point will be a PRA that *as a minimum* addresses internal events and internal flooding hazard groups AND
- The base PRA will have been peer reviewed against the ASME/ANS standard and RG 1.200, Rev 2
- Some iteration on technical adequacy can be expected
 - The technical adequacy of the PRA model for the application is assessed taking into account the significance of the elements of the model to the risk metrics required for the application

Process for Assessment of PRA Results for the Purpose of Risk-Informed Decision Making



Steps 1 and 2: Define Application and Assess Capability of PRA to Model the Cause-effect Relationship*

- Step 1: Identify appropriate guidance documents for the application to determine:
 - Acceptance guidelines (risk metrics)
 - Hazards/POSS to be considered
 - Some applications can be hazard specific (e.g., NFPA 805)
 - Cause-effect relationship (modeling the impact of the change)
- Step 2: Check to see the PRA model has the right “hooks”

* (NUREG-1855 Stage B)

Step 3: Initial Comparison of PRA Results with Acceptance Guidelines*

- Necessary when the scope of the PRA does not address all the risk contributors required by the acceptance guidelines
- Quantitative results give an indication of the margin to the acceptance guidelines
- An analysis of the results identifies the initiating events, accident sequences, and functions and systems whose unavailabilities have an impact on the risk metrics for use in the screening and bounding analyses conducted in Step 4

* This step and step 4 are skipped when the PRA is full scope or is of sufficient scope for the application

Step 4: Assess Adequacy of the Scope of the PRA*

- The purpose of this step is to assess whether the missing scope (hazard groups or POSs) items can be screened or their contributions to the risk metrics bounded so that they are not significant contributors
- Approach varies with application and hazard: *examples* are given in Appendix A for a particular application and plant but are not intended as definitive guidance
- If neither cannot be demonstrated, then either a PRA model is constructed, or, if possible, the implementation of the proposed change is restricted so that the contributions from the missing scope items can be neglected

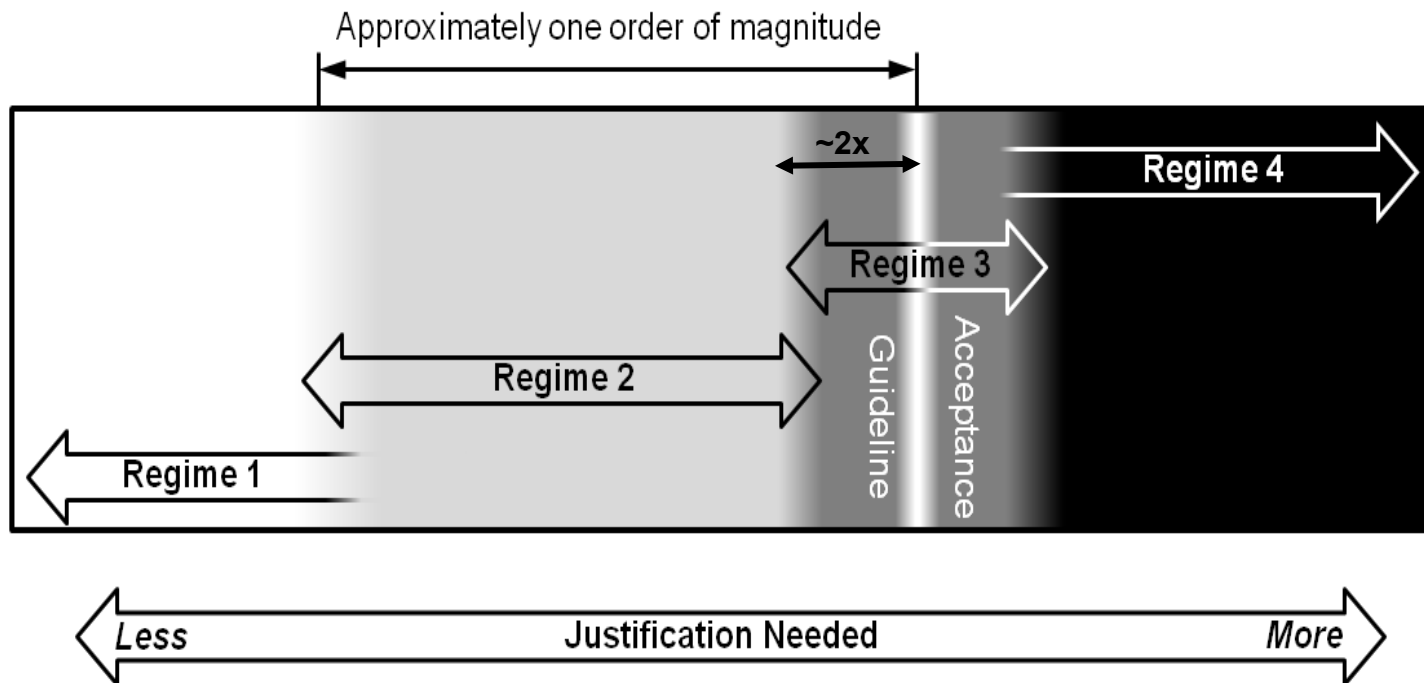
* (NUREG 1855 Stage B-3, C)

Step 5: Final Comparison with the Acceptance Guidelines

- Described in Chapter 4 of the report following largely the guidance in EPRI 1016737 addressing both parameter and model uncertainty
- Includes a graded approach to addressing uncertainty depending on where the point estimate results lie with respect to the Regimes defined in NUREG-1855, Rev 1 Chapter 9

A Graded Approach to Dealing with Uncertainty

- Initial assessment (steps 3 and 4) and comparison against acceptance guidelines (step 5) using point estimates
 - Assignment based on conservative results if sensitivity studies show decision at “boundary” between regimes.



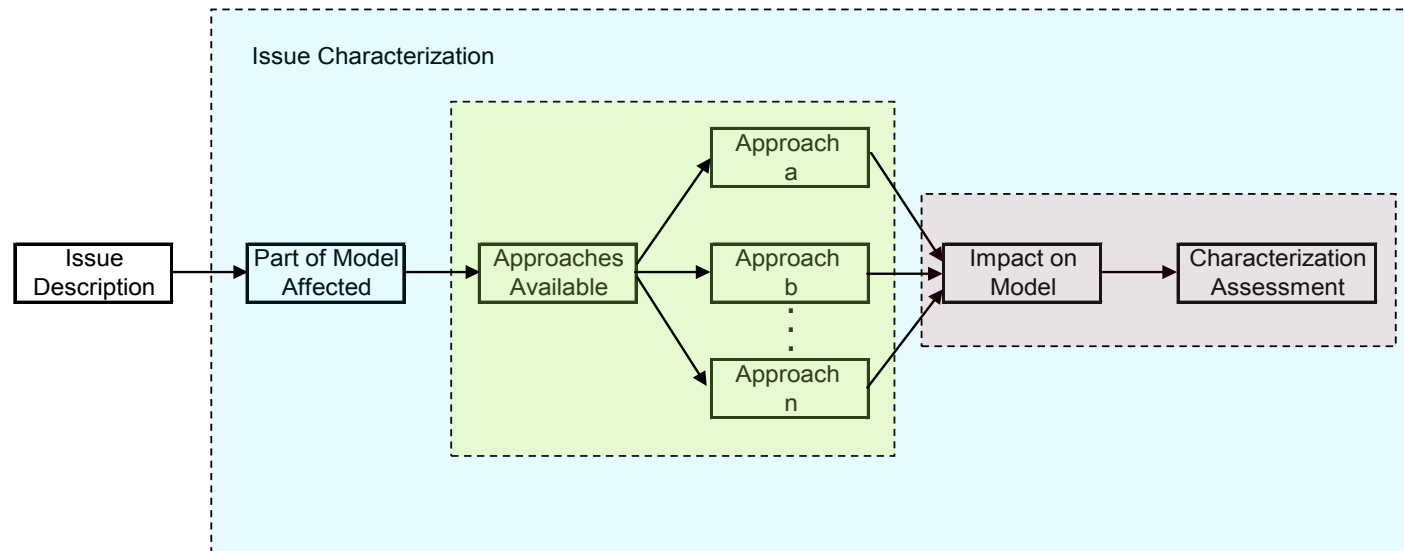
A Graded Approach to Dealing with Uncertainty (2)

- In Step 5 address uncertainties:
 - When results are far from the acceptance guidelines, parameter uncertainty is generally unimportant (except where it obviously is (e.g., ISLOCA))
 - Propagate mean values, perform qualitative assessment of SOKC
 - Within a factor of two assess how to address the SOKC using guidance in the EPRI documents (e.g., 1016737)
 - If SOKC appears to be important according to the EPRI guidance, perform a quantitative assessment of parameter uncertainty
 - As model uncertainties may be large, they must be assessed in all regimes
 - Guidance on this assessment provided in Ch. 4 (next slides)
 - Generic sources of model uncertainty to consider provided in EPRI 1016737 as well as this document.

* (NUREG 1855 Stage D, E)

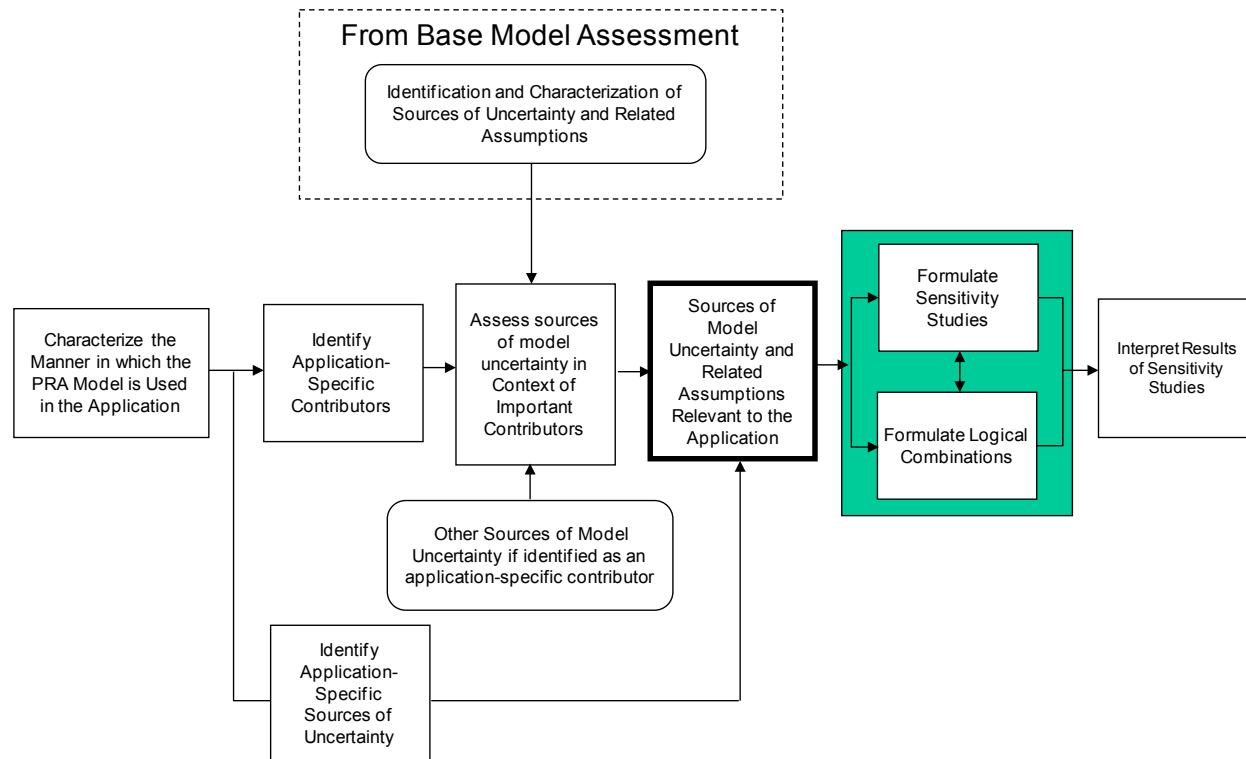
Approach for Characterizing Model Uncertainty

- Similar to approach in EPRI 1016737, but expanded to encompass fire, seismic, LPSD, and Level 2 (as applicable)
- Base Model Assessment



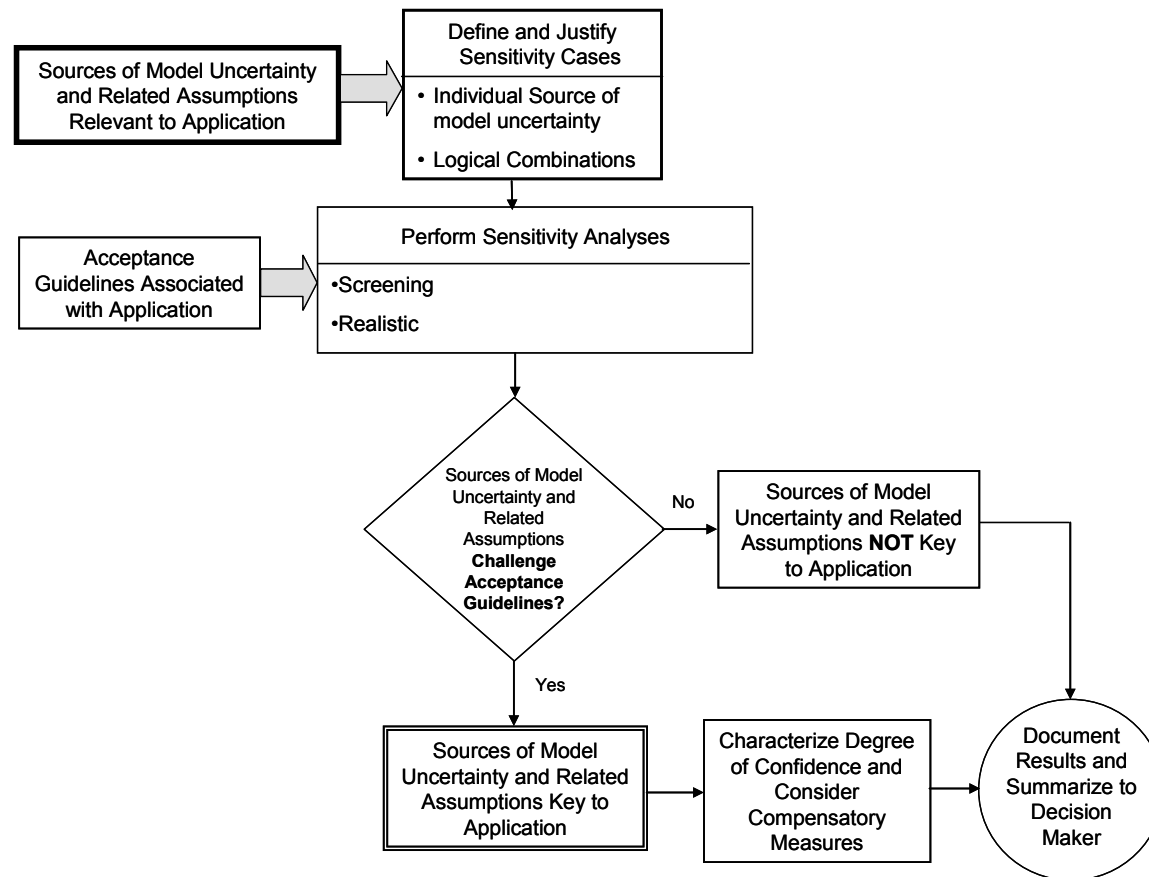
Approach for Dealing with Model Uncertainty

- Process for identifying potential key sources of uncertainty in applications



Approach for Dealing with Model Uncertainty

- Process for identifying potential key sources of uncertainty in applications (cont'd)



Step 6: Integrated Decision-making

- Discussed in Chapter 5 of the report
- Topics addressed include:
 - Comparison of the results to the guidelines
 - Characterization of results for the decision-maker, and options for when the guidelines are challenged
 - Integration of the PRA results with the other principles of risk-informed regulation (RG 1.174)
 - Defense-in-depth
 - Dealing with large uncertainties

* (NUREG 1855 Stage F)

Integrated Assessment

- Integrated assessment based on the five principles of risk-informed decision-making (RG 1.174):
 1. The proposed change meets the current regulations unless it is explicitly related to a requested exemption (i.e., a “specific exemption” under 10CFR 50.12, “Specific Exemptions”).
 2. The proposed change is consistent with a **defense-in-depth** philosophy.
 3. The proposed change maintains sufficient safety margins.
 4. **When proposed changes result in an increase in core damage frequency or risk, the increases should be small and consistent with the intent of the Commission’s Safety Goal Policy Statement.**
 5. The impact of the proposed change should be monitored using **performance measurement** strategies.
- Specific topics addressed are DID and large uncertainties since they are potentially the most contentious

Proposed Approach for addressing DID*

- Develop guidance that recognizes the hierarchical aspect of DID
- Recognize its role in addressing unknown factors
- Focus on the way the LAR affects the presumed balance between the levels of protection:
 - Physical changes to the plant
 - Changes to operating practices
- Provide guidance on the integration of DID concerns with the other principles
 - Dealing with the unknown

** This approach has not been endorsed by NRC*

The Role of DID in an Integrated Decision

- Identify and assess changes that may adversely affect achieving a required safety function when the level of redundancy or diversity is limited or where significant uncertainty exists,
- Identify and assess the impact on DID of cross-cutting changes (e.g., administrative changes, maintenance practices) that affect multiple safety functions or cut across levels of protection
- Use for things that can not be addressed directly by the PRA, e.g., late containment failures

Interaction with other Principles – Principle 4 _

Change in Risk is Small

- Meeting the acceptance guidelines of Principle 4 demonstrates that, at an integral level, DID is maintained for issues related to CDF and LERF, and that are represented in the PRA
- However, if the change affects only low frequency and low order cut sets, DID is still a relevant consideration
 - Contrast proposals for a change to surveillance frequency on RPV with change to surveillance frequency on LPCS system (BWR)
 - Former appears in single element cut sets, the latter in cut sets of high order, i.e., other systems perform the same function
 - Furthermore, there is much more uncertainty about the RPV failure probability than that of the LPCI system
 - Therefore, while the change for the RPV might be allowed, the case would need to be much stronger

Addressing Large Uncertainties

- Problem statement – results from:
 - Paucity of data
 - Need for extrapolation (e.g., flooding) and/or use of models (e.g., seismic)
- Manifestation in PRA models
 - Hazard characterization
 - Characterization of impact
 - Characterization of response to hazard (e.g., HRA)
- Special case – cliff edge effects
 - A small change in hazard results in a large change in impact (e.g., CCDP)

Large Uncertainties (Cont'd)

- Process for addressing large uncertainties
 - Step 1: Understand role in decision-making
 - Step 2: Understand potential to affect decision
 - Step 3: Disposition
 - Step 4: Integration with other principles
 - Defense-in-depth
 - Safety margins
 - Performance monitoring

Large Uncertainties – Steps 2 & 3

	Potential for Large Uncertainties	Disposition
1	Potential Over-estimation of Computed Risk	See 2 & 3
2	Known Over-estimation of Risk Impact	Describe impact of conservatism in application
3	Masking of Change in Risk	Sensitivity study that removes the conservative treatment
4	Potential Under-estimation of Computed Risk	Sensitivity of the risk metrics to changes in the mean estimate – is it reasonable to assume that these sources of large uncertainty do not present a threat to the decision?
5	Cliff-Edge	“Reverse Engineer” hazard likelihood

Results Decomposition (Chapter 3)

- The contributors to the risk metrics are identified
 - Hazard groups
 - Initiating events
 - Accident sequences/classes
 - Functions/systems
 - Cut sets
- Required for
 - Step 3 to identify risk drivers during screening
 - Step 4 to construct the bounding analyses
 - Step 5 to identify:
 - Sources of uncertainty that could influence the result (key sources)
 - Portions of the PRA model treated conservatively and possibly distorting the conclusions
 - Assessment of significance of SOKC

Appendices

- Appendix A: Example Implementation in a Risk-Informed Regulatory Application [RHR example]
- Appendix B: Generic Sources of Fire PRA Modeling Uncertainty
- Appendix C: Generic Sources of Seismic PRA Modeling Uncertainty
- Appendix D: Generic Sources of LPSD PRA Modeling Uncertainty
- Appendix E: Generic Sources of Level 2 PRA Modeling Uncertainty

Issue Description		Issue Characterization	
Topic	Discussion of Issue	Part of Model Affected	Possible Approaches for Model Uncertainty Issues (Not Exhaustive)
Plant Operational State Definitions (LPOS)			
1. Omission of POSs needed to complete evolutions resulting from safe stable states from at-power scenarios	Some level 1 scenarios end in a safe-stable state, such as successful feed and bleed, successful shutdown to terminate SG tube leak, or sump recirculation following a LOCA. These may lead to prolonged shutdown to allow for repair. While they are low frequency scenarios, the complete cycle to restoration of power is not generally modeled.	This is associated with the characterization of shutdown POSs, and represents a level of detail or completeness issue.	N/A – Level of Detail

Next Steps

- EPRI document 1026511 was sent out for review by the EPRI scope and quality working group and to NRC
- No fundamental issues were raised, but the comments received were helpful in identifying where the document lacked clarity, and will be addressed before publication.
- Publication is planned for December, 2012 (prior to anticipated release of NUREG-1855, Rev. 1)
 - *NRC needs to publish draft prior to December 2012.*



Revision 1 to NUREG-1855, “Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decisionmaking”

Presented to ACRS Subcommittee on PRA

October 19, 2012

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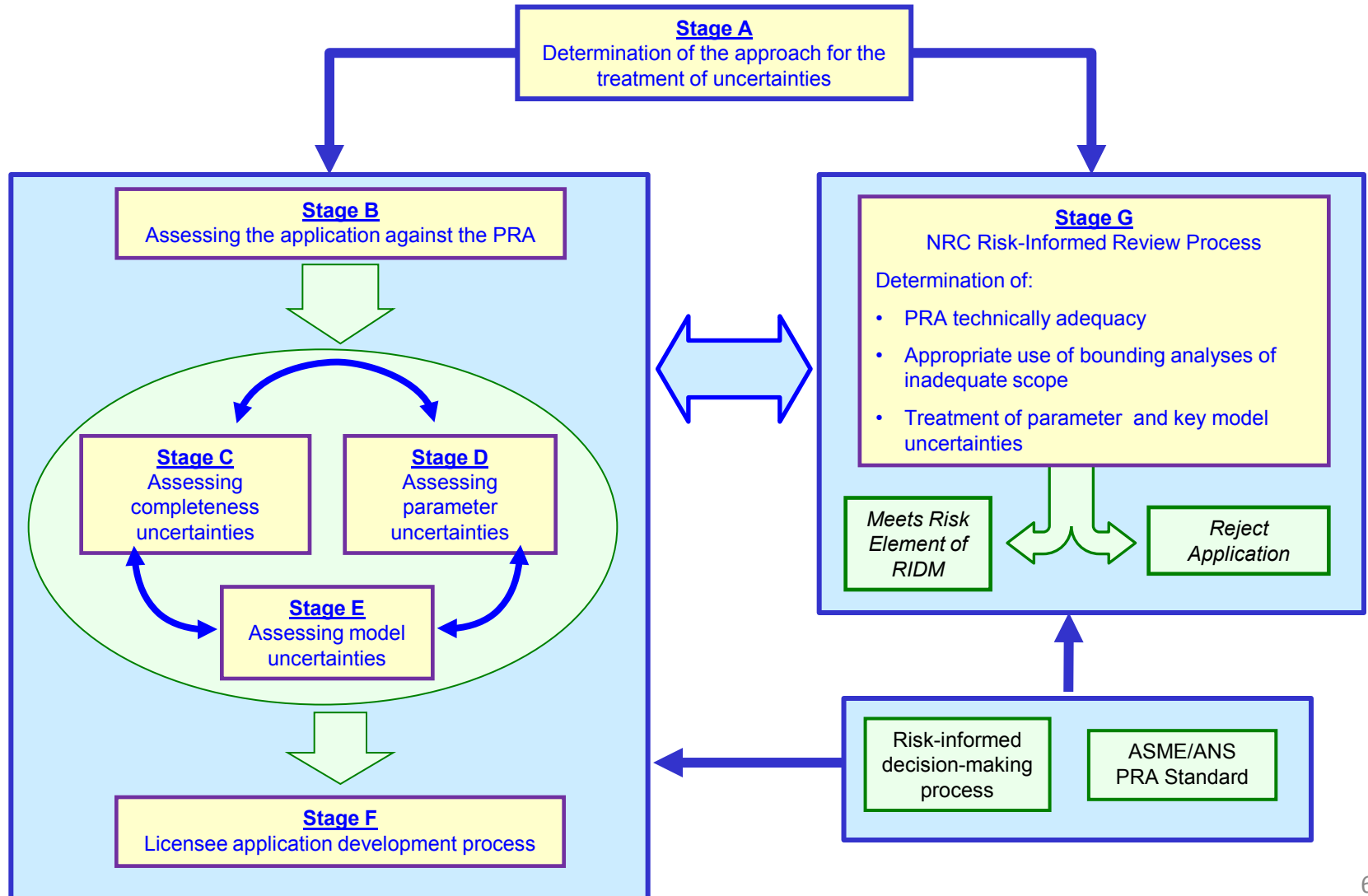
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- ☐ Objectives
- ☐ Background
- ☐ NUREG Restructure
- ☐ ACRS Feedback
- ☐ Changes to NUREG
- ☐ Steps Forward

- ❑ 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.

- ❑ Major changes involved a restructuring of the document and development of an explicit process which describes the guidance for the treatment of the uncertainties.
- ❑ The scope was expanded to include sources of uncertainties associated with low power and shutdown, internal fire, seismic, and Level 2 PRA
 - The expanded scope primarily affected the EPRI report.
- ❑ Met with subcommittee on June 19, 2012 to present progress.
- ❑ ACRS provided feedback and NUREG was revised.

NUREG RESTRUCTURE



SUMMARY OF FEEDBACK FROM ACRS SUBCOMMITTEE

1. Re-evaluate use of subjective terms
2. Address issues regarding sources of model uncertainty (i.e., definition thereof, consensus models)
3. Clarify the relationship of uncertainty in PRA and deterministic analyses with defense-in-depth and safety margins
4. Consider inclusion of a more generic and global process that is applicable to all risk-informed decisions/activities including those performed by the NRC
5. Expand discussion of bounding, conservative, and realistic analyses (i.e., definitions, examples used)
6. Re-evaluate discussion on the process of truncating and subsequently determining the importance of the SOKC
7. Revisit the discussion of a “reasonable alternative” for a sensitivity analysis

CHANGES TO THE NUREG

1. NUREG was reviewed for subjective terms and revised.
 - The term “reasonable” was replaced with “credible” and a definition for credible was provided
 - The term “broad acceptance” was removed from the definition of source of model uncertainty (see page 86).

CHANGES TO THE NUREG

2. Revisions made to address issues with the definition of sources of model uncertainty and consensus models as well as the treatment of model uncertainties for consensus models.
 - *From page 18:* There may be cases where there may be more than one consensus model for addressing a specific issue. An example is the Multiple Greek Letter and the Alpha methods for quantifying common cause failures. In such a case, any one of the consensus models can be used. Multiple consensus models should provide similar results. If they do not, then they do not meet the requirement for being a consensus model and an evaluation of the associated model uncertainty should be made utilizing the guidance in Section 7.

Currently there is no agreed-on list of consensus models nor is there a formal process to establish such a list. However, as a first step in establishing such a process, EPRI has compiled a list of candidate consensus models [EPRI, 2006a]. This list includes common approaches, models, and sources of data used in PRAs. At this time, the NRC has not reviewed this list although specific models, approaches and data may have been approved for specific risk-informed applications.

CHANGES TO THE NUREG

2. (Con't) Revisions made to address issues with the definition of sources of model uncertainty and consensus models as well as the treatment of model uncertainties for consensus models.
 - *From page 86: 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 alternative data, approaches or models is known to have an impact on the PRA model and results. 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 submitted by relevant experts and which has a sound technical basis. Relevant experts includes those individuals with explicit knowledge and experience for the given issue. An example of an assumption related to a source of model uncertainty is battery depletion time. In calculating the depletion time, the analyst may not have any data on the time required to shed loads and thus may assume (based on analyses) that the operator is able to shed certain electrical loads in a specified time.*

CHANGES TO THE NUREG

3. Revisions made to clarify the relationship of uncertainty in PRA and deterministic analyses with defense-in-depth and safety margins
 - *From pages 20-21:* Appropriate consideration of the uncertainty in both deterministic and probabilistic assessments is required to properly interpret the results. Both the deterministic and probabilistic components implement Principles 2 and 3, which take into account the impact on defense-in-depth and on safety margins. The probabilistic component implements Principle 4, acceptable risk impact. A treatment of the uncertainties in the probabilistic analysis is implicitly required to implement Principles 2, 3, and 4 of risk-informed decisionmaking. Treatment of probabilistic analysis uncertainties is the focus of this report. Although uncertainties in a deterministic analysis are not explicitly addressed in this report, the types of uncertainties and the methods for evaluating them are the same for a deterministic assessment.

CHANGES TO THE NUREG

4. A new subsection describing the generic application of the treatment of uncertainties was added to Section 3, which includes the following three parts:
 - Understanding the risk-informed activity
 - Understanding the sources of uncertainty
 - Addressing the uncertainties in the decision making

CHANGES TO THE NUREG

5. Expanded the discussion of bounding analyses.

- *From pages 54-55:* In the context of a specific PRA scope or level-of-detail item, a bounding analysis provides an upper limit of the risk metrics and includes the worst credible outcome of all known possible outcomes that result from the risk assessment of that item.

The following text was removed from pages 54:

Consequently, a bounding analysis must consider both the frequency of the event and the outcome of the event.

CHANGES TO THE NUREG

5. (Con't) Expanded the discussion of bounding analyses.

- *From page 53-54:* Performance of a bounding analysis utilizes available knowledge to set an upper limit on where the answer may realistically lie. When compared to a best estimate probabilistic evaluation, a bounding value may represent a 95%, 98%, or some other percentile of the best estimate value. However, it is not practical to establish a specified percentile in the definition of a bounding analysis since one could only meet that definition by performing a best estimate analysis. Instead, a bounding analysis can only provide a point estimate of the risk metric associated with a missing scope or level-of-detail item. To accomplish this, a bounding analysis can be broken down into individual constituent parts with bounding values, assumptions, and models utilized in each piece of the evaluation. For example, a bounding scenario may be defined utilizing a bounding initiator frequency, assumed failure of available mitigating systems, and a maximum possible release of hazardous material. If the uncertainty distribution is available for one of the parameters such as the initiator frequency, a value representing a high percentile (e.g., 95th percentile) could be selected as a bounding value.

CHANGES TO THE NUREG

6. Revised discussion on the process of truncating and subsequently determining the importance of the SOKC.

- *From page 71:* ...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 values can be underestimated due to the effect of the SOKC directly, as well as due to incorrect screening out of cutsets in truncation due to neglect of the SOKC in calculating cutset frequencies. Appendix 6-A of this section discusses both these potential effects of the SOKC in more detail...

From page 75: ...It should be noted here that, due to the large number of cutsets in a PRA model, it is common to screen out cutsets with frequencies below a certain truncation value at this point in the analysis. Caution needs to be exercised to avoid incorrect screening out of cutsets in truncation due to neglect of the SOKC in calculating their frequencies. Appendix 6-A of this section discusses this possible effect of the SOKC in more detail, along with other potential SOKC effects...

CHANGES TO THE NUREG

6. Revised discussion on the process of truncating and subsequently determining the importance of the SOKC.
 - *From page 83:* ... If the frequencies of the MCSs are calculated using a point estimate that does not account for the SOKC, and the point estimate frequencies of some of the MCSs containing correlated basic events are smaller than this truncation value, a subset of these MCSs may be incorrectly discarded because the correlated frequency (that accounts for the SOKC) of each MCS in this subset is actually larger than this truncation value...

CHANGES TO THE NUREG

7. The term “reasonable” was replaced with “credible.” The discussion was amended with the following paragraph. No impact was identified on Stage F.
 - *From page 99: ...Section 4.3.1 of EPRI report 1016737 [EPRI, 2008] and Section 4.4.1 of EPRI 1026511 [EPRI, 2012] provide guidance on determining a reasonable range over which a sensitivity analysis should investigate model uncertainty.*

STATUS AND NEXT STEPS

- ❑ NRR and NRO are being provided with the two-week notification of impending publication of the draft NUREG for public review and comment
- ❑ Will address NRR and NRO comments simultaneously with public comments
- ❑ Revision 1 to NUREG-1855 is scheduled for publication in early 2013